Popular Science

FOUNDED MONTHLY 1872

RADIO SECTION
PAGE 74

How you can replace "B" batteries with alternating current.

An easy way to add a radio-frequency amplifier to your set.

Amazing plane its own parachute

See page 30

APRIL 25 CENTS

Music

Far away in a spacious hall, a great orchestra unrolls the rich melody-pattern of a master symphony. Far away in a vast cathedral, an organ pours forth the theme of an age-old hymn. Far away in a world-famed opera house, a drama is revealed in song.

Far away—but with a turn of the dials—*near!* Near—vivid—real—with the Radiola Super-Heterodyne. You are part of the audience—a silent, moveless listener to magical sounds.

Radiola Super-Heterodyne

The Radiola that brings in far stations without ground or antenna—that gets the station you want—gets it always at the same marked spot—gets it simply—clearly! Its tone is as famous as its performance.

This symbol of quality RCA *is your protection*

RADIO CORPORATION OF AMERICA
Sales Offices:
233 Broadway, New York
10 So. La Salle St., Chicago, Ill.
28 Geary St., San Francisco, Cal.

"There's a Radiola *for every purse"*

Radiola

REG. U. S. PAT. OFF.

POPULAR SCIENCE MONTHLY
SUMNER N. BLOSSOM, Editor
April, 1925

The Magic Stuff that Saved Nome

How, in the Blood of Horses, Are Produced Invisible Conquerors of Human Disease

By Edward Mott Woolley

A NEW Epic of the North, greater by far than any from the master pens that have celebrated the Arctic, was written recently when seven relays of intrepid mushers, lashing their dog teams to unprecedented efforts, sped over the trackless Alaskan trails to carry life-saving antitoxin to the city of Nome, stricken by an epidemic of diphtheria, the famous "black death" of the North.

Fighting withering cold, fierce gales, and roaring blizzards, these Spartans of the snows urged on their fleet huskies to accomplish the 660-mile journey from Nenana to Nome in the record-breaking time of 127½ hours—approximately 5½ days—faster by far than dog sled ever had traveled before, even in the "derbies"—races for generous prizes—in which the best Alaskan dog teams contest each year. Never did the purses and honors of those derbies prove such reason for pressing on to the very limits of human endurance as did the call of suffering humanity that seemed to ring in the ears of the drivers as they struggled over the snows.

Twenty-seven persons lay sick of the dread disease when Gunnar Kasson and his 13 dogs pushed wearily into the settlement with the precious 20-pound package containing 300,000 units of the life-saving serum. Twenty-eight others had developed what appeared to be symptoms of the scourge while Kasson, and Leonard Seppala, most famous of all Alaskan sled drivers, and Tom Green, and Shannon, and Nicolai and the others were carrying the needed serum over the snowswept trails. A frightful list of patients, this, in a community with a population of between only 600 and 800 souls. Compute the same proportion of disease cases in a city of a million, and you will appreciate how critical the situation was.

The eyes of the whole world have been turned toward the little settlement on the fringe of the Arctic Circle ever since the telegraph first told of the grim drama that was being played near the top of the world. All honor has been paid to the courageous drivers, who, with striking modesty, said that their feat was "all in the day's work" and insisted upon passing credit along to their dogs; also to Dr. Curtis Welch, of the U. S. Public Health Association, who, with the assistance of a single nurse, battled ceaselessly with the hosts of death before the antitoxin arrived.

Heroes in the Race with Death

Leonard Seppala, champion musher of Alaska, with two of his famous lead dogs. In the face of a raging blizzard they sped over 245 miles of trackless snow in the longest of seven dog-sled relays that carried 300,000 precious units of diphtheria antitoxin to plague-stricken Nome. All Alaska speed records were broken

Germs to Fight Germs

Inspecting the growth of bacteria in laboratory cultures. The killed bacteria, injected into the blood of animals, arouse the life cells to produce the disease-resisting antibodies that are contained in the antitoxin serums

But there are other men—other animals, too—deserving of credit for the parts they played in that thrilling episode. They did not face the rigors of the Alaskan winter, nor dare death under circumstances so dramatic that the attention of the world was focused on them. Yet in their own way they served, and served well, for it was they who produced the magical stuff—the antitoxin—without which the heroic efforts of the Alaskan sled drivers would have been in vain.

IT IS a fascinating story, this tale of the efforts of science to end the ravages of diphtheria, pneumonia, typhoid fever, spinal meningitis, erysipelas, lockjaw and the other deadly maladies of humankind through the production of what scientists call "bacteria antibodies," or "immune serums," which are Nature's weapons against the germs of disease.

All around us continually lurk whole armies of invisible enemies of human life, inhabiting that vast and mysterious underworld we call disease, and watching always for a chance to gain ingress to our bodies. We speak of these microscopical despoilers as bacteria, which by the use of a little imaginative license we may endow with attributes of crafty intelligence, ever

eager for the deadly contact with human kind that will give them entrance to the blood stream through mucous membranes, pores, or skin abrasions, or, with greater cunning, by way of the hair follicles.

BACTERIA, indeed, would speedily destroy us and wipe out human and animal life except for a mystifying force within ourselves known as "natural immunity." This is a wonderfully fascinating subject, about which little was known until comparatively recent times. But when biologists began to unlock the secrets of natural immunity they not only revealed a new and unsuspected world, but discovered strange possibilities for the treatment of disease.

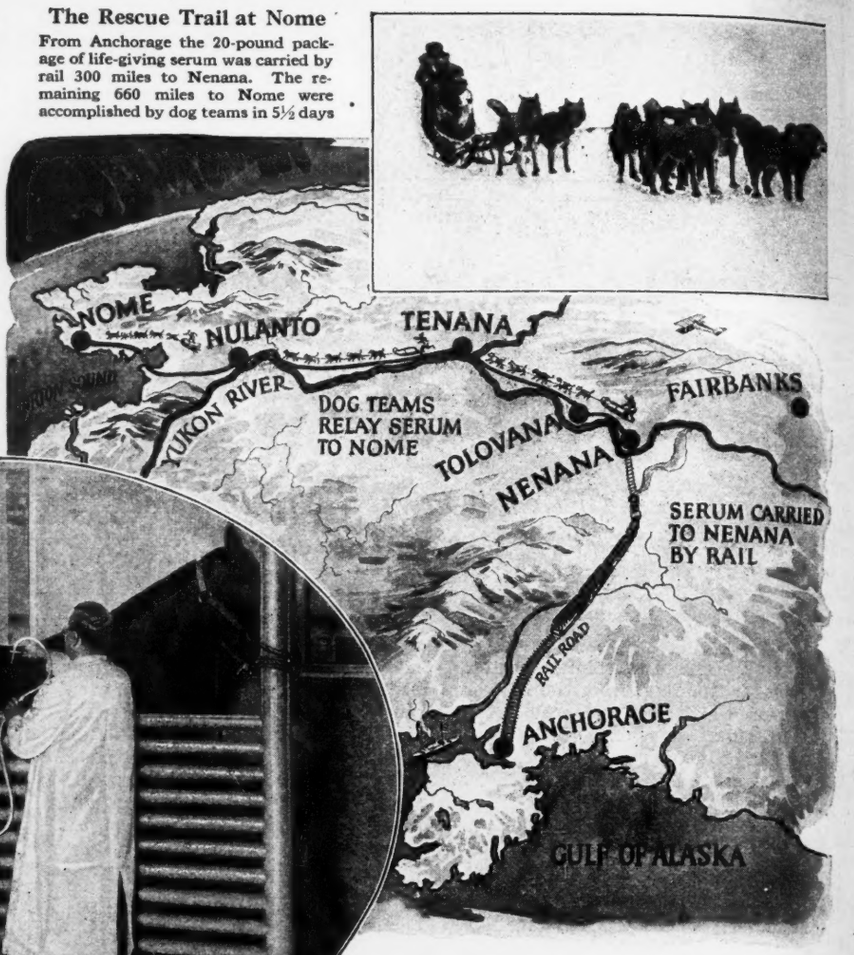
They found that natural immunity was a tangible force, lying largely in the ability of the body cells to produce antitoxins and other substances with which to repel the attacking enemy, bacteria. These discoveries were pivoted on studies of the body cells.

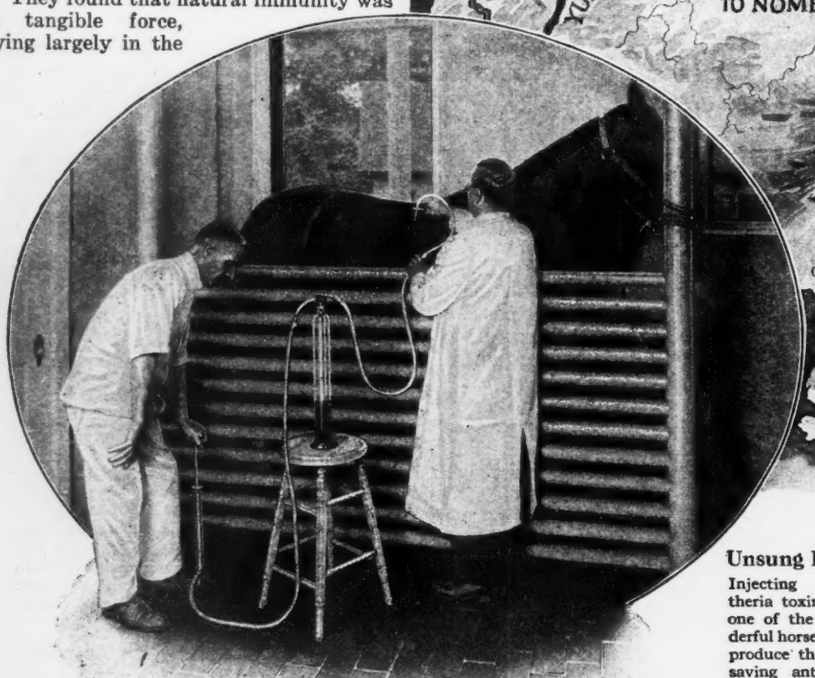
Without going far into the realms of fancy, we can say that every human cell is virtually an animal in itself, and that the human being is made up of vast colonies of these cell animals. Some of them are working to build and maintain the body. Others, known as the "white cells" or "leucocytes," or sometimes "phagocytes," are wandering cells, with power to elongate and propel themselves from one point of the body to another, passing through the tissues with a peculiarly penetrating power. The phagocytes are among the chief fighters of disease germs, which they devour. With a powerful microscope they can be seen in motion, carrying fragments of bacteria.

To accomplish the overthrow of the bacteria and reduce them to a form in which they can be digested by the phagocytes, the body cells produce and throw off into the blood a mysterious something, possibly chemical substances, which scientists call "antibodies." These antibodies never have been identified as visible entities. Just what they are remains to be discovered; but although they never have been seen, their presence or absence can be ascertained positively. Just what antibodies will do is known to a certainty. Every different form of disease, moreover, is combated by its particular antibody in the blood.

The Rescue Trail at Nome

From Anchorage the 20-pound package of life-giving serum was carried by rail 300 miles to Nenana. The remaining 660 miles to Nome were accomplished by dog teams in 5½ days





Unsung Hero

Injecting diphtheria toxin into one of the wonderful horses that produce the life-saving antitoxin in their blood

A Magic Weapon Against Plague

This little bottle contains 10,000 units of diphtheria antitoxins, sufficient for one treatment. Thirty times this amount was carried in the dramatic dash over the snow to Nome, where 27 persons lay sick of the dread disease

Every person in normal health has enough antibodies in his system to destroy a reasonable quantity of almost any sort of bacteria. This is natural immunity. When an unusually large quantity or especially virulent type of bacteria gains access, or when the subject is weakened or even temporarily exhausted, the natural immunity is overcome and disease gets the mastery.

SO SCIENCE, as represented in the fields of medicine, bacteriology, and biology, has discovered by extraordinary experiments how to produce antibodies artificially in the blood of horses or other animals, and how to separate and purify the serum containing the antibodies after it is drawn from the blood stream of the animals, making it safe for injection into the blood of persons suffering from infectious diseases.

At Glenoben, Pa., not far from Philadelphia, I saw recently a herd of wonderful horses, which are devoting their lives to growing in their blood these mysteriously invisible, yet tremendously real antibodies. These horses haul no drays and drag no plows, but live in equine luxury, protected by every sanitary device, fed on the choicest of stable provender, groomed and petted and exercised as the aristocratic horse should be; all because their blood streams are the garden soil of science. Without suffering or inconvenience they produce, through nature's own miracle, the very substances

Leonard Seppala and his Siberian huskies which bore the brunt in Alaska's most dramatic race against death. Togo, Seppala's famous lead dog, was lost on the journey

that we ourselves produce in our own blood, in normal health, to crush or poison invading microbes of death.

These horses receive at first minute hypodermic injections of killed bacterial cultures or their poisons. This immediately arouses the animal cells to produce antibodies. Gradually the doses are increased, and at last the horses are painlessly bled. The serum is refined, tested for purity, safety and activity, and then bottled.

IT WAS these very horses that supplied most of the antitoxin rushed over the snows to relieve disease-infested Nome.

It was these very horses that, only a few months earlier, supplied the serum that checked the outbreak on the Pacific Coast of the now rare pneumonic plague, the black death that killed millions of people in the fourteenth century.

In the foreign section of Los Angeles a woman died from a strange and galloping disease, and of those who attended her funeral nearly all met with a similar fate. Los Angeles turned to medical science for the identity of the dread invading germs, and the answer was quick and positive.

Rare though this diabolical disease has become in modern times, the biological laboratory in Philadelphia, which I have mentioned previously, had an anti-plague serum actually in stock, awaiting the possible call of emergency. Within an hour after the transcontinental telephone brought word to the laboratory of Los Angeles' need, 500 doses of the serum were packed, and an automobile was off for a flying-field near New York. Speed records were broken, and the air mail carried the only known remedy to the Western Coast in a couple of days. As a result, the invisible enemy was put to rout. The quarantine was raised in a few weeks, with the death count less than 40.

THRILLING incidents such as this, and the more recent race with death across the Alaskan snows, of course are infrequent in the war that science is waging against destructive bacteria. Yet it is such a gigantic struggle that its underlying dramatic elements are unescapable.

It is a wonderful warfare, according to Milton Campbell, president of the H. K. Mulford Company, of Philadelphia, to whom I am indebted for most of the material contained in this article. All its forces are directed along ultra-scientific lines, for the saving of human lives. It deals not only with the sick—those actually in the grip of bacteria—but with the protection of millions of persons still uninfected but moving among the hazards of disease.

The scientific prevention of disease is revolutionizing medicine. Medical men of today are generally agreed that the physician of the future will devote a large share of his skill toward the prevention of infectious diseases, not alone by sanitation, but by actual immunizing of his patients.

Compare the present and past history of disease and you will be struck by the progress being made in immunology.

Giving Their Blood

From the blood streams of these fine animals science painlessly draws the priceless serum that imparts immunity

Mortality statistics bear eloquent testimony to the marvels immunology has accomplished with smallpox, hydrophobia, cholera, bubonic plague, and other diseases of the same malignant type.

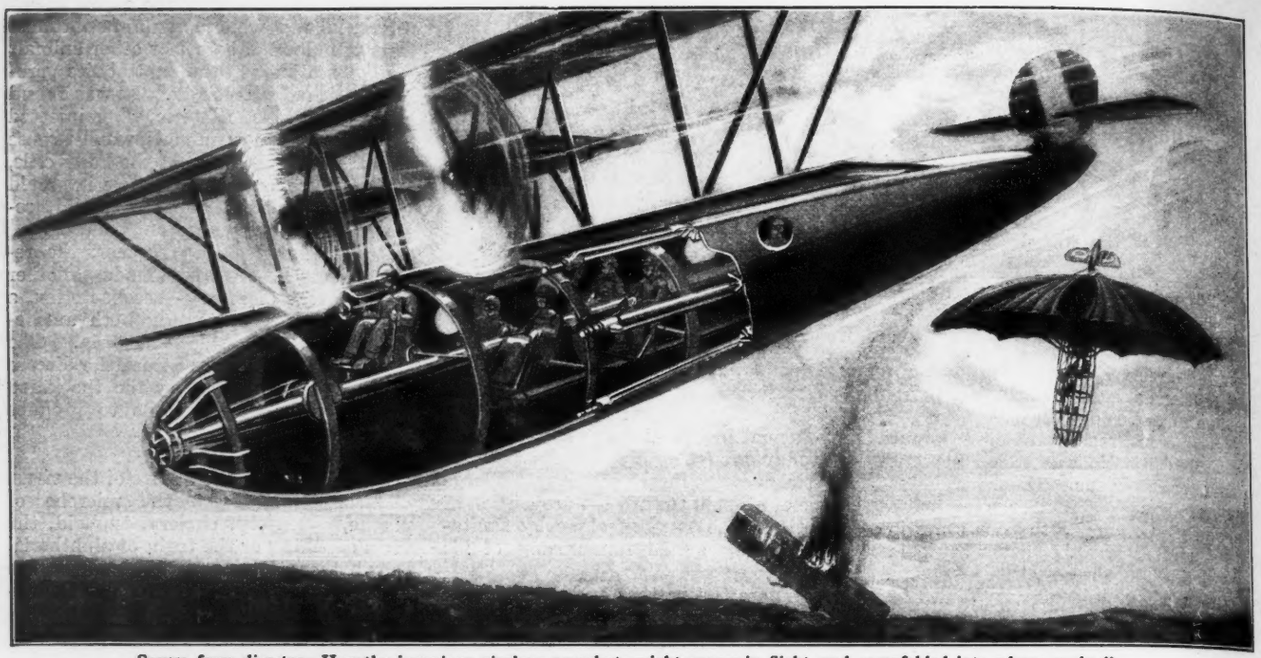
Two principal weapons are employed by science in the cure and in the prevention of disease by immunology — bacterins and serums. A bacterin is a solution containing the germs themselves, killed; while a serum is obtained from the blood of horses or other animals containing the antibodies produced artificially. It was found that killed bacteria, when injected into man or animals, would arouse the antagonism of the body cells, much as the live bacteria would do, and that the cells would proceed to generate antibodies.

Going a step further, the research scientist made another great discovery—serobacterins, a product containing both antibodies and killed bacteria. The ready-made antibodies attack the disease that affects the patient, while the killed bacteria stimulate the cells to produce natural antibodies.

WHATEVER the nature of the virus, whether it be the microbe of plague, dysentery, cholera, typhoid, the virus of rabies, or the toxin of diphtheria, or whether the microbes are killed or living, this process, known as sensitization, confers on them properties that

(*Continued on page 138*)

Then, in the laboratory, the serum is separated from the red blood corpuscles and purified to make it safe for injection into the blood of persons, there to crush invading microbes of death



Secure from disaster—How the ingenious airplane-parachute might appear in flight, and as unfolded into a huge umbrella, with wings and motors released, floating safely to earth. Contrast with the plane crashing in flames in the background

Amazing Plane Its Own Parachute

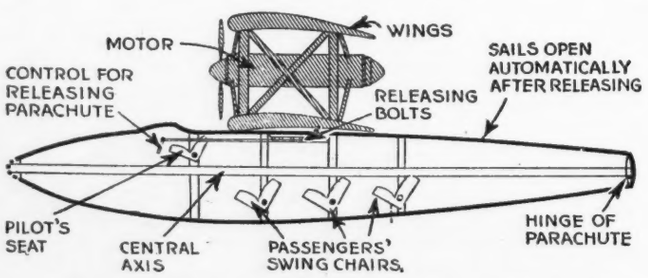
In Emergency the Wings Drop off and the Body Unfolds

By Truman Stevens

IMAGINE, for a moment, that you are seated in a great passenger airplane, riding across the sky thousands of feet above the earth.

Suddenly comes a sharp explosion. The machine dives dizzily. A moment or two more, you think, and it will be the end.

But at the instant the thought of certain disaster flashes across your mind, the pilot pulls a lever and, to your amazement, the wings, motors, gasoline tanks, and propellers fall away from the streamlined fuselage. Simultaneously, as the wingless car plunges in a nose dive, the rounded sides of the fuselage itself begin to open outward in segments, like orange peel. In the rush of air, these segments, joined by webs of strong canvas, and all hinged to a center shaft at the rear, quickly open wide to form a gigantic umbrella.

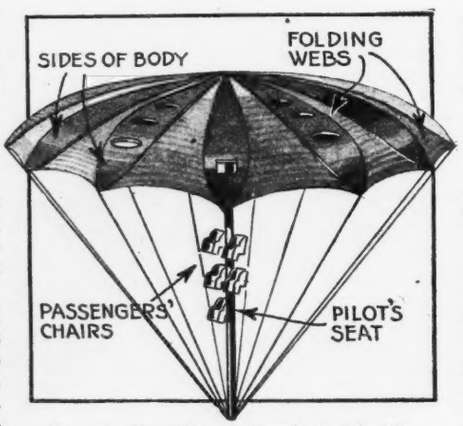


Design of the machine. The shaded portion represents the wings, power plant, and gasoline tanks, all released by a control lever in the pilot's cockpit. The same lever simultaneously releases the parachute

INSTEAD of crashing to almost certain death, you find that you are still riding easily in the same comfortable chair. The breathless plunge downward has ceased. Now you are floating earthward gently under the dome of a giant parachute.

Just such a combination airplane and parachute, amazing in its conception, yet astonishingly simple in design, is the recent invention of Captain Lepinte, a French aviator, who has gained distinction for the production of several other safety devices for airplanes.

Stripped of its superstructure, the flying machine is an immense folded parachute in itself.



How the sides of the airplane body, joined by canvas webs, open to form the parachute. Notice how the passengers' seats, pivoted on the center shaft, swing automatically to an upright position as the nose of the machine points downward after the parachute is freed

The secret that lends practicability to the invention lies in the manner in which the separable parts are held together so that they can be released almost instantly. The fastenings are screws with interrupted threads, which may be locked together or unlocked simply by one-eighth turn of the screw. The entire mechanism for releasing all the various fastenings is controlled by the pilot in a single operation.

THUS, simply by swinging the handle of a lever, the pilot can separate the wings, motors, and propellers from the fuselage. The same movement releases the segments of the fuselage covering that open outward to form the parachute. The complete release requires not more than a few seconds. To prevent the big umbrella from turning inside out, wire stay ropes connect the outer rim of the parachute with the nose end of the center shaft. Danger of the plane's catching fire after an accident in the air would be obviated by the release of the fuel tanks.

An interesting feature of Captain Lepinte's invention is the manner in which he provides that the passengers shall remain seated upright in their chairs even when the nose of the car is pointed downward. He has designed the seats so that they are attached by pivots to the center shaft of the fuselage. Thus, whatever angle the fuselage takes, the chairs always swing to an upright position.

Captain Lepinte estimates that the car would descend with a velocity of not more than nine feet a second.

Airplanes Hurled to Bits in Test

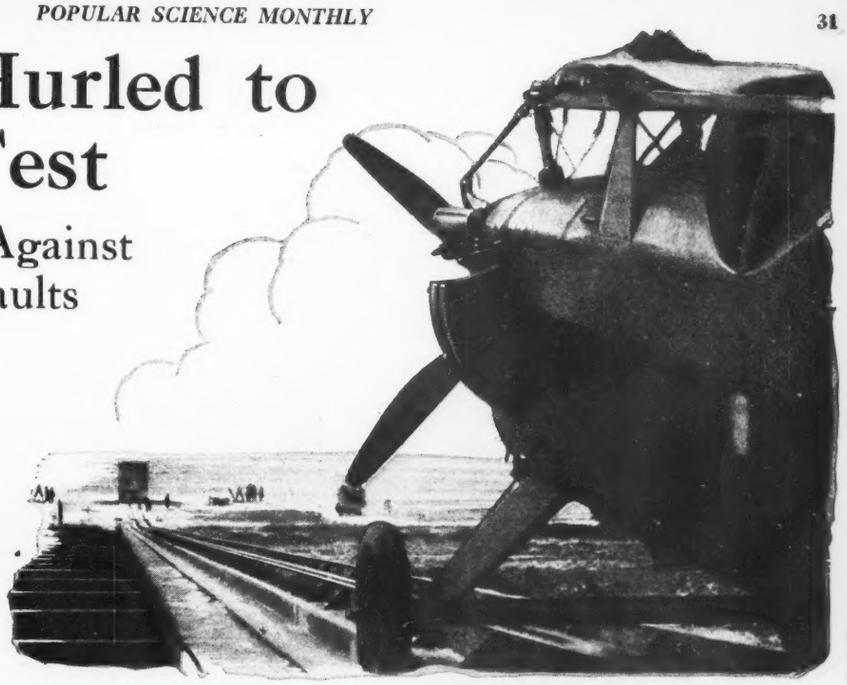
Terrific Crashes Against Wall Show Faults

By Newton Burke

WITH crashes that echoed through the surrounding country for miles, four airplanes recently were hurled to destruction down an incline and against a concrete wall at Wilbur Wright Field, Dayton, Ohio, in a spectacular test conducted by Army Air Service engineers to ascertain the principal structural weaknesses of aircraft and to determine the causes of airplane collapses, as well as explosions and fires in fallen planes.

The four planes selected for the test were old and of obsolete models. The wings were removed to prevent the planes from rising. The machines were sent away separately from a concrete platform 25 feet high, from which an inclined track led to a concrete wall 100 feet away. Each plane was lashed to the track, and its main gasoline tank and the gravity tank on top of the fuselage were filled with 100 gallons of gas. Then the motor was started, the throttle was thrown wide open, and the rope that held the craft cut with an ax.

Immediately the plane plunged forward. Gathering momentum with each revolution of its propeller, it attained a speed of more than 100 miles an hour before it reached the bottom of the incline. The crash heard as each plane in turn struck the thick wall of concrete was terrific. Bits of wood and metal were cast high in the air. In one case a small sliver from a propeller rose 1000 feet in the air and fell 100 feet away. A spray of gasoline drenched photographers and engineers who were watching the demonstration from shelters 25 feet away.

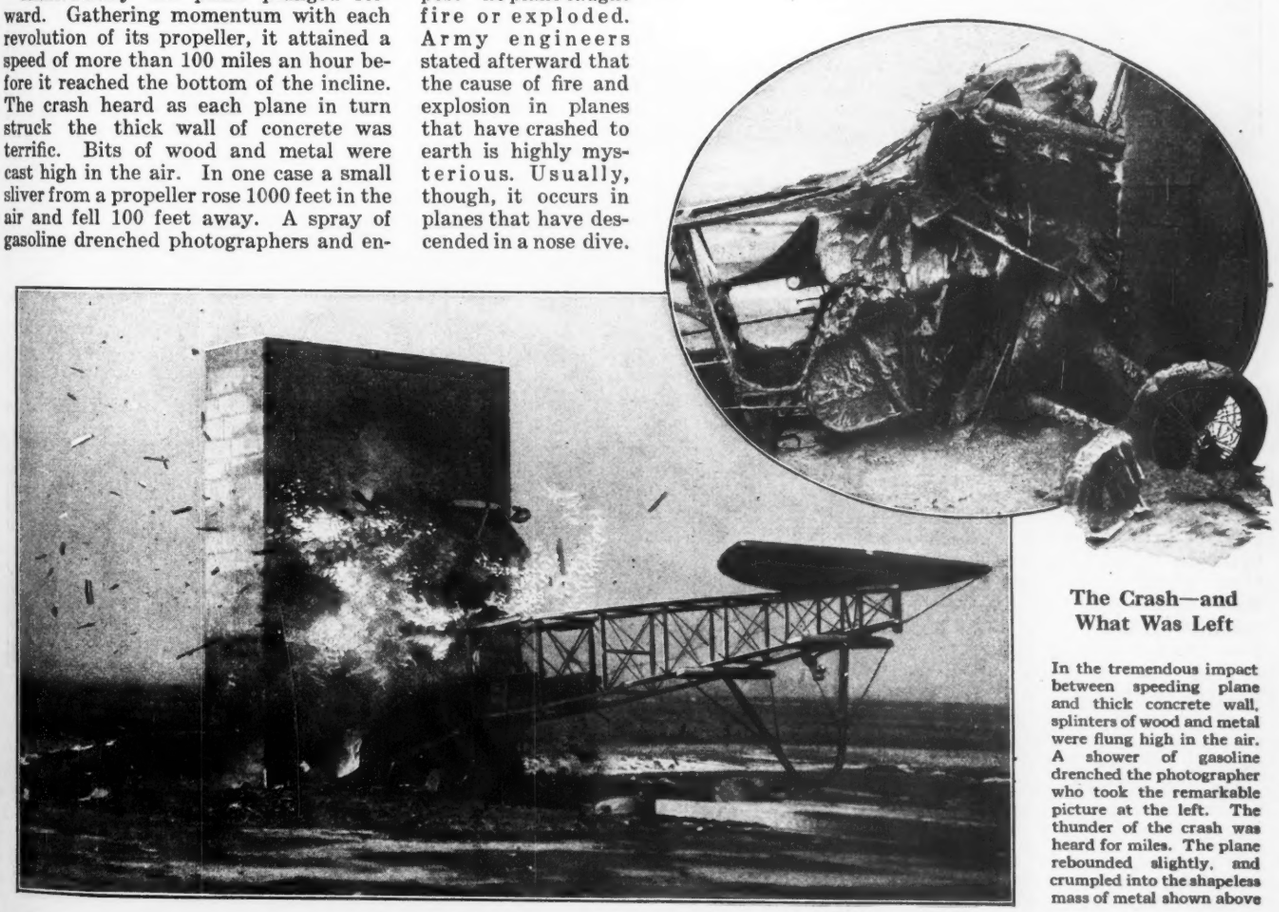


Headed for Destruction—One of the four pilotless test planes at the top of the incline, just before plunging downward and crashing into the concrete wall seen in the distance

In each case the propeller shaft embedded itself in the concrete to a depth of about a foot. The frail propeller was reduced to splinters. Each plane rebounded slightly from the wall, then crumpled into a shapeless and shattered mass of metal.

In one respect the test failed of its purpose—no plane caught fire or exploded. Army engineers stated afterward that the cause of fire and explosion in planes that have crashed to earth is highly mysterious. Usually, though, it occurs in planes that have descended in a nose dive. Crashing in this position causes the entire structure to be deluged with gasoline, thus readily starting a fire if sparks occur. This method of descent was not reproduced in the tests, the runway down which the planes sped being inclined at a comparatively small angle.

The army engineers are not yet ready to announce the results of the tests regarding structural weakness of aircraft.



The Crash—and What Was Left

In the tremendous impact between speeding plane and thick concrete wall, splinters of wood and metal were flung high in the air. A shower of gasoline drenched the photographer who took the remarkable picture at the left. The thunder of the crash was heard for miles. The plane rebounded slightly, and crumpled into the shapeless mass of metal shown above

The TAMING

How this terrible giant has
It lifts huge mountains and

By Robert

Blasting a River Channel—A Man-Made Geyser

Dynamite now can be put to work in water as well as in earth or rock. This spectacular photograph shows how tons of water were hurled a hundred feet in the air during the blasting of a channel in Cotee River, near Port Richey, Fla. The completed channel, 20 feet wide and seven feet deep, connects the Cotee River for navigation with the Gulf of Mexico

SEVENTY thousand pounds of dynamite—enough to blow up New York City if carefully placed—went off one day down in the mountains of Virginia. With the touch of an electric button a mile or two away, the detonating spark darted with incredible speed through hundreds of auger-like borings in the vast pile of rock and earth, touching the metal caps embedded in thousands of dynamite sticks. With a single impulse these chemical contrivances let loose their titanic force, lifting the whole mountain from its base and toppling i over into a deep gorge adjacent.

Thus the mountain, upside down, formed the foundation for a great dam—a structure that would have required enormous masonry work otherwise, far down in the depths of the canyon.

On the lowlands not far from this somersaulted mountain, I stood the other day and watched a crew of men place dozens of dynamite sticks in the ground in a straight line, perhaps six or eight feet apart. Dynamite sticks are round and innocent looking, as thick as two fingers, and a few inches long. They look like compressed sawdust, stuck together with molasses, maybe.

Why the sticks should be put in the ground in such a way might not be apparent to the casual observer; but presently there came a quick staccato noise, as if a row of soldiers in some hidden trench had fired their guns almost in unison. Along that straight line where the sticks of dynamite had been, a great upheaval of dirt rose perhaps 10 or 15 feet, falling in a dusty shower.

And then, when the cloud had settled, there was revealed something almost magical. Where the line that marked the dynamite had been lay a ditch, four or five feet deep and wider than that at the top—a drainage channel almost as neatly dug as if a hundred laborers had toiled for days with picks and shovels.

Long-time research work has made it possible within the last year to do things of this sort, along highly specialized lines. Scores of scientifically trained men spend their lives prying out of science explosives of kinder disposition but of greater capacity.

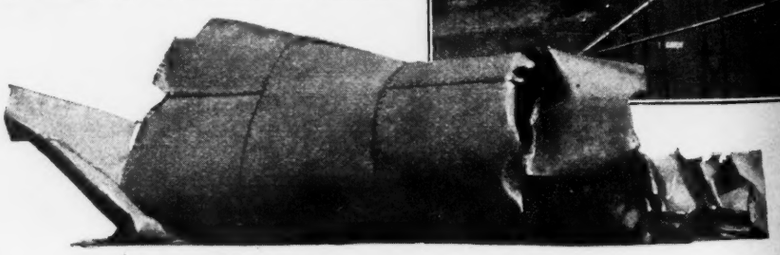
To learn something about these men and their work, I went to the experimental station of E. I. Du Pont de Nemours & Company near Wilmington, Del., and there Dr. C. M. Stine, Director of Chemical Research, showed me some of the magic that modern research has wrought in taming high explosives for the every-day uses of man. He showed me how amazingly the giant dynamite has been harnessed to save time and labor.

"Vast improvements have been made in commercial explosives within the last 20 years," Doctor Stine told me, when I referred to the ditch-digging job I had witnessed.

"YOU may think that dynamite works fast in this sort of excavation," he said; "but relatively the time required for the wave of explosion to run along the line of the ditch is long—maybe a good fraction of a second.

"The control of the speed of explosion is an important phase of the work with dynamite. It may seem grotesque to say that dynamite may be slow or fast. But apparatus has been devised for measuring the rapidity of explosion where the velocity is three or four miles a second.

"To the every-day spectator the whole



How Dynamite Cut Off a Chimney Top

Clipping a five-ton section from the top of a steel stack at Gibbstown, N. J., was accomplished recently with dynamite almost as neatly as if it had been sawed off. The upper picture shows the falling section in midair. Below: How it looked when it struck the earth

# of DYNAMITE

been put to work for us—
cuts wood into stove lengths

Bracefield

series of explosions seems almost simultaneous. To the research chemist, however, the difference in speed is of great importance. He can quicken the wave or slow it down as he pleases."

Doctor Stine described recent progress in removing the danger of handling high explosives in large quantities, citing the fact that in New York State is a seven-mile ditch dug cooperatively by farmers with dynamite.

"IN THE old days," he reflected, "you recall reading of the laborer who exterminated himself while thawing dynamite. The elimination of the necessity for thawing, through the production of a non-freezing dynamite, is one illustration of the work the scientist has accomplished. In the iron-ore country, non-freezing dynamite now is used at 30 degrees below zero."

Out on the highways of the Rockies next month, automobiles will get through with ease, where in former years motor traffic was often impossible before June, or even July. The modern method of opening such roads is to bore into the dense mass of ice and snow and break it up—with dynamite.

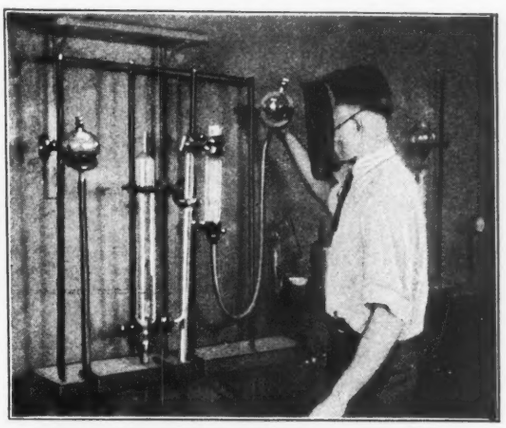
In the same manner ice jams in the rivers are blasted. In northern New York State not long ago a huge mass of ice formed above a large paper mill, and the impounded waters menaced the plant. Dynamite was shipped in response to a telegram, and the ice was dislodged in a day.

Quite as spectacular is the blasting of log jams that not only threaten to flood whole regions, but prevent the logs from floating to the sawmills. Here again dynamite comes to the rescue. It always lets loose the barricade.

In ordinary wrecking jobs, too, dynamite now does, in a few seconds, the work that formerly required days. In a college town, not long ago, a towering old brick smokestack alone remained of an erstwhile factory. For years it had disfigured the college settings. At last the contract was let to have it taken down brick by brick—but a dynamite contractor offered to remove it at a small fraction of the price involved by the other method. Beginning with small charges near the base and gradually enlarging the opening, he felled the huge chimney as accurately as the woodsman fells a tree, along a given line. So close was the reckoning that it had to graze one of the college buildings in its descent.

Safe to Handle

Most of us think of dynamite as something extremely dangerous to handle. As a matter of fact, experts can cut it, scrape it, burn it, and even drop it without its exploding. Thousands of tons of it are transported every year by railroad, wagon, and motor-truck



Testing Explosives

This laboratory apparatus, known as a nitrometer, is employed for testing the inflammability of nitroglycerine, guncotton, and nitrate of soda

Quite kindly is the dynamite that cuts from the hillside slices of white or polychrome marble. Once upon a time the individual workman quarried these slabs with infinite labor. But now small charges of dynamite are inserted along an indicated line and exploded simultaneously, with a gentle dynamic tap. Yet it cuts out the slabs as neatly as the old-time quarryman could do it.

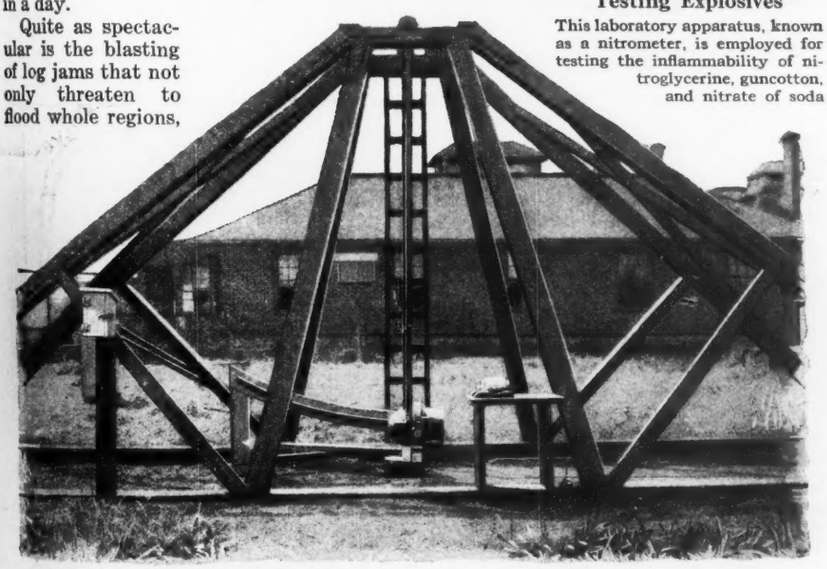
Almost benign also is the dynamite used for tree planting.

"On one occasion," Doctor Stine told me, "a group of women gathered for this purpose, and not knowing that dynamite was to be used they stood about the workmen as the sticks of explosive were cut in pieces. They began to inquire what the stuff was, and fled in disorder when they found out.

"WHEN the dynamite was placed in the hard soil and exploded, there was just a murmur and a tiny upheaval of earth over each charge. But the soil was loosened far down into the ground. Not only was the planting accomplished with ease, but the young roots had every chance to grow easily.

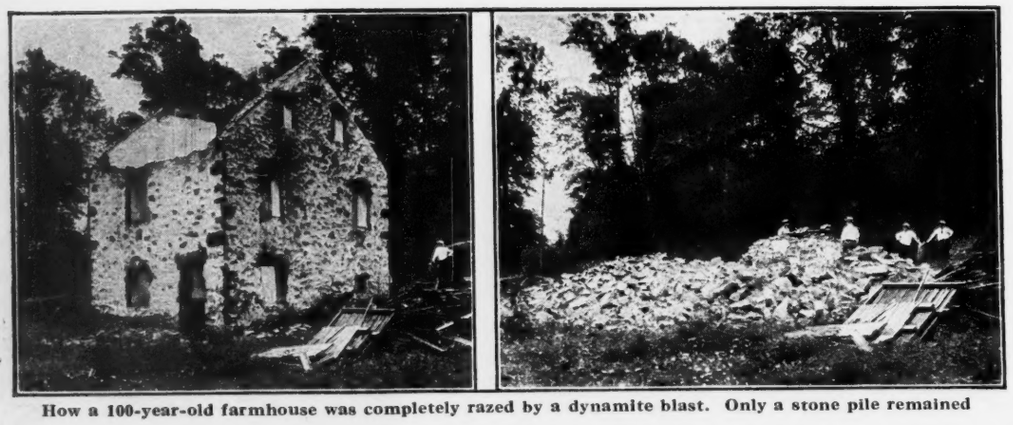
"This particular use of dynamite has become widespread, in the setting out of orchards, for example. Moreover, extraordinary results are on record where orchards had practically ceased bearing and were rejuvenated through the loosening of the soil with dynamite.

"Dynamite is an adjunct of farming in cut-over regions, where whole fields are freed from stumps in a few days. Contractors go even further and split the wood



How the Force of Dynamite Is Measured

Another testing apparatus, the ballistic pendulum, measures the explosive force of dynamite. The percussion is made to act against the ball of a pendulum, causing the pendulum to vibrate. The amount of vibration then is measured on a calibrated arc, registering the force expended



How a 100-year-old farmhouse was completely razed by a dynamite blast. Only a stone pile remained

into stove lengths at the same time. In Florida a large grower of vegetables found his whole crop in imminent danger of ruin by water that backed up over his land after torrential rains. He called in a dynamite contractor, who told him that the small ridge that held the water could be blown away and the crops saved, but that the rush of water probably would carry away a small bridge over a creek below. The grower guaranteed to replace the bridge—and the job was done in a few hours. His crop was saved.

"Subsoiling *via* the dynamite method is now widely employed. Twenty million pounds of explosives are used every year for agricultural purposes."

IN MINING, of course, explosives play an exceedingly important rôle. Here, though, their use in the past has been surrounded with hazards that have presented extremely difficult problems. If you could watch the dynamite research men in their investigation of these mine problems, you would find a huge steel chamber, called a "gallery," which duplicates the dust and other conditions in the mines. This atmospheric content of the mine has been scientifically manufactured and let loose in the gallery.

Now watch the dénouement. With the gallery sealed and the scientists watching the indicating devices at a safe distance outside, a tiny spark is flashed over a wire, and the muffled explosion in the chamber exemplifies the actual blasting underground. Now the scientific apparatus measures all the gases exuded. Of course, the problem is to manufacture explosives that will cut down toxic fumes to the minimum.

"All through the experimental work with dynamite has run never-ending research to make this explosive safer," Doctor Stine told me. "To start with, we had the treacherous nitroglycerine, an oil that had a habit of exploding on the least provocation. It was once used in large quantities despite its terrible disposition—particularly in the oilfields. Specially designed wagons transported it, with all sorts of cushion arrangements; yet not infrequently serious accidents resulted.

"Today this same nitroglycerine, with all its old appalling force, has been harnessed into the compound called 'dynamite,' so you can cut it, scrape a hole in it, burn it, or even drop it. The explosive is transported safely in great quantities on the railroads, and even goes through wrecks without exploding.

"All this has not come about accidentally. It is no mere question of pouring the nitroglycerine into sawdust or some other absorbent, and molding it into cylindrical sticks. A most extensive chemical research has done it. Today the manufacture of high explosives stands twelfth in the list of hazardous occupations.

"Some of the ordinary constituents of dynamite, aside from sawdust, are wood pulp, cornmeal, flour, sodium nitrate or sulphur, combined with high explosive compounds that have been built up in the chemical laboratory with a view to obtaining a chemical molecule especially adapted to industry.

"Much of our advance in producing better high explosives is due to scientific control of the chemical reactions of complex chemical compounds. Large-scale chemical reaction is no longer a matter of individual judgment. The rate of mixing ingredients, the quantities and the temperatures and pressures are controlled to the fraction of a degree. Mechanical devices make the manufacture as foolproof as possible.

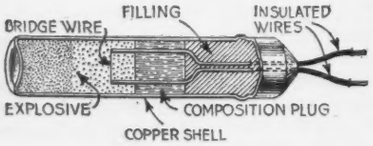
"THEN, after all other problems have been considered, the research man is called upon to produce dynamite on a commercial basis. It must be made cheaply enough to be marketable. In his search for cheaper high explosives, he has competed with nature in the synthesis of the raw materials that constitute the starting point in high explosives. For example, the glycerine forming the basis of many nitrated compounds used in dynamite is usually obtained as a by-product of soap. The research chemist has perfected methods for producing artificially a glycerine identical with that occurring in the animal fats.

"Sometimes sugars are used in making

(Continued on page 143)

Felled by Dynamite

Dynamite charges set off around the base of this brick chimney chopped it down almost as accurately as a woodsman fells a large tree



The Detonating Cap

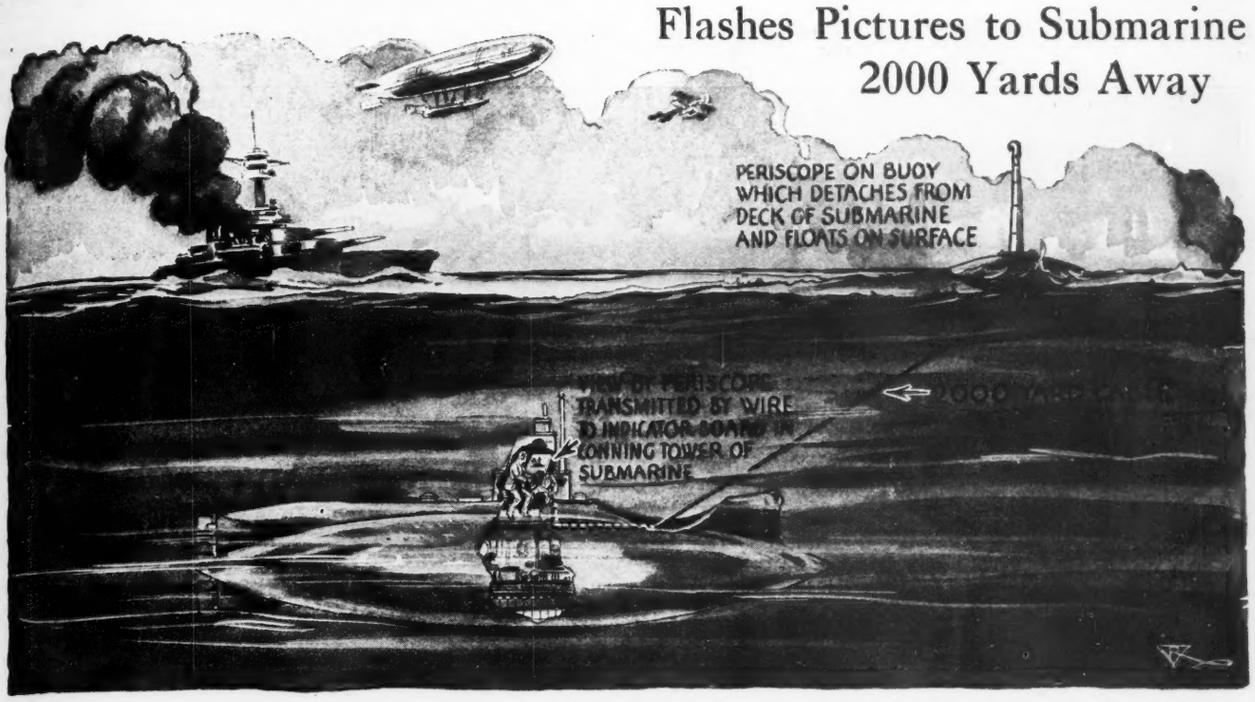
The cap is filled with fulminate of mercury, through which is bridged a metallic filament, finer than a hair. A minute electric current makes this fine wire red hot, firing the charge

Changing a River

The map shows how new channels were dug by dynamite for the meandering Jackson River to provide a straight right-of-way for the Chesapeake & Ohio Railway near Clifton Forge, Va. At the left is an irrigation ditch dug by dynamite. The sticks of dynamite were placed at six-foot intervals

New Buoy Periscope Sees and Hears

Flashes Pictures to Submarine 2000 Yards Away


PERISCOPE ON BUOY WHICH DETACHES FROM DECK OF SUBMARINE AND FLOATS ON SURFACE
TRANSMITTED BY WIRE
CONNING TOWER OF SUBMARINE

Instead of being an integral part of the submarine, Dr. V. A. Clarke's ingenious electric periscope is mounted on a buoy, which floats 2000 yards from the conning tower when an observation is being made. When not in use, the device is carried in the superstructure. Pictures and sounds of approaching vessels or airplanes are transmitted electrically to the observers over a copper cable, which also controls the buoy

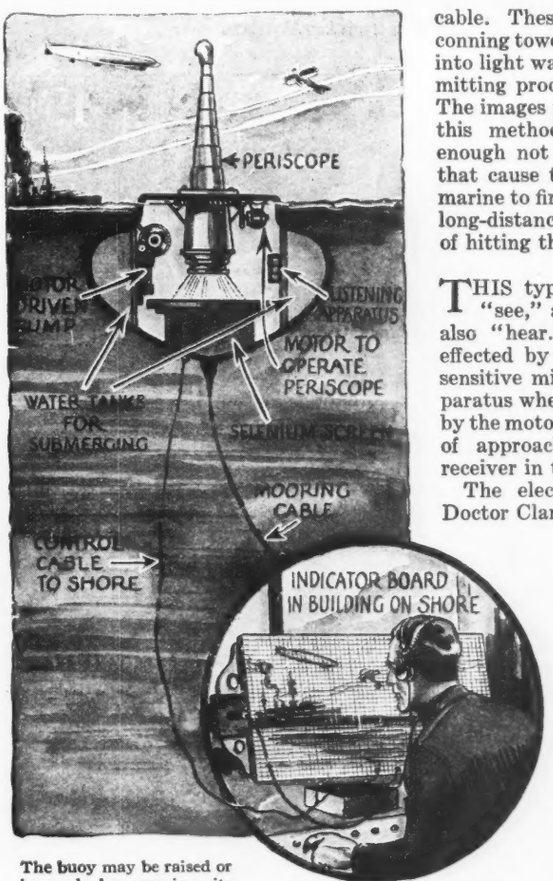
AN AMAZING new type of periscope, which floats on the surface far away from the submarine and carries to the latter views of the surrounding sea by means of principles similar to those employed in the radio transmission of pictures, has just been taken under consideration by the U. S. Navy Department.

The periscope is the invention of Dr. V. A. Clarke, of New York City. Its purpose, of course, is to permit a submarine to observe without the possibility of detection by surface ships. According to the inventor, the device doubles the efficiency of a submarine.

The periscope is mounted in a cigar-shaped buoy, about 12 feet long and three feet wide. When the submarine is under way, this buoy fits into a compartment in the superstructure. When an observation is to be taken, the buoy is released, and is towed at the end of a copper cable 2000 yards long.

Electric controls in the conning tower of the submarine permit the periscope to be raised or lowered by varying the water ballast of the buoy by pumping. Other controls operate an electric motor by means of which the device may be rotated through 360 degrees. At 14 feet, its maximum elevation, the periscope's radius of vision is said to be 11 miles.

BENEATH the periscope tube is a series of selenium cells connected with a sort of radio transmitter. An image of whatever the periscope "sees" falls upon these cells, and the variations of light intensity due to the shadows and high lights of this "picture" cause corresponding variations in electrical impulses that pass to the submarine through the copper cable. These impulses are received in the conning tower, where they are reconverted into light waves by a reverse of the transmitting process, and viewed on a screen. The images produced in the submarine by this method are said to be accurate enough not only to identify the objects that cause them, but to enable the submarine to fire upon ships seen through the long-distance periscope with every chance of hitting the mark.



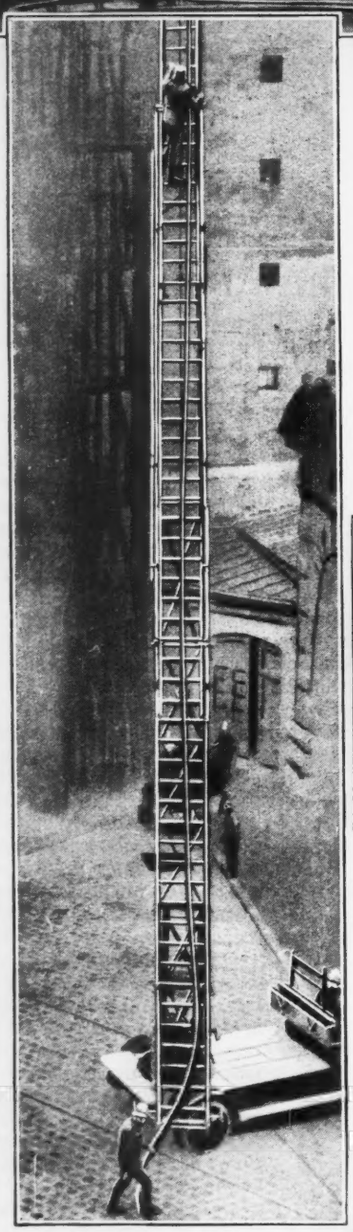
The buoy may be raised or lowered by varying its water ballast. At its full height, 14 feet, the range of vision is 11 miles. A microphone and amplifying device transmit sounds to the submarine or to a station on the shore, adding greatly to the submarine's efficiency

THIS type of periscope not only can "see," according to its inventor, but also "hear." The latter operation is effected by supplying the device with a sensitive microphone and amplifying apparatus whereby sounds such as are made by the motors of airplanes or the propellers of approaching ships are heard in a receiver in the conning tower.

The electric periscope, according to Doctor Clarke, would insure safety to the occupants of a submarine by guarding the craft against attack by enemy vessels. If the observer found the periscope surrounded by hostile ships, he would cut the cable connecting it with the submarine, and leave the periscope behind as a blind while the submarine escaped. Doctor Clarke also asserts his invention might be used as an automatic sentinel to warn coast-defense fortifications of coming attack from the sea. His device, he states, can be built complete for about $15,000. The ordinary telescope type of periscope costs between $8000 and $12,000.

Newest Weapons for Fire Fighters

French Motor-Car Engine Pumps 24 Streams of Water



A Dizzy Climb

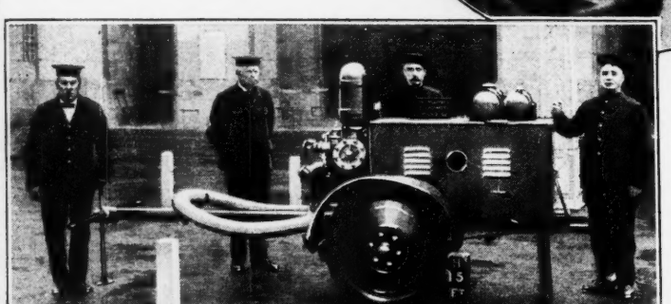
Among the most important pieces of modern fire equipment, especially in large cities with tall buildings, are the extension ladders. This one, in Paris, rises to a height of nearly 100 feet. This view shows French firemen in action

All from One Engine

This spectacular photograph shows firemen in Paris demonstrating the latest fire-fighting equipment. Twenty-four streams of water are being pumped from the Seine River by the recently devised single engine shown at the bottom of this page. Paris claims to have the world's most effective fire-fighting system

Protected from Smoke

Paris firemen are equipped with a new type of mask that is said to afford complete protection from smoke and fumes

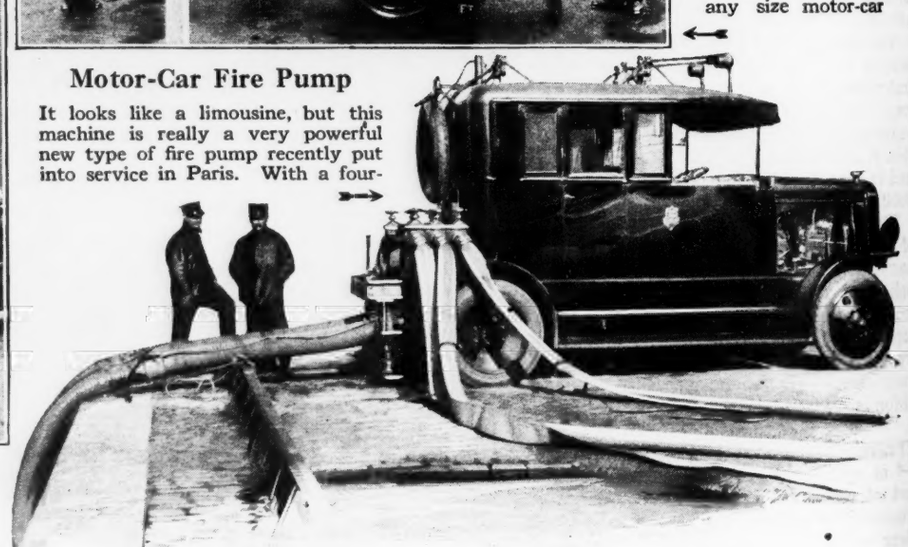


Trailer Pump

An extremely light and compact pumping apparatus just constructed for rural fire departments in England is mounted on a trailer that can be hauled to the scene of the blaze by any size motor-car

Motor-Car Fire Pump

It looks like a limousine, but this machine is really a very powerful new type of fire pump recently put into service in Paris. With a four-cylinder engine it is capable of delivering 24 high-pressure streams of water. The water is pumped from the Seine River through the large hose seen at the left of the picture. Notice the battery of hydrants at rear of car, to which the fire hoses are attached



Which of these two houses is broader? The one at the right, you will say. Yet actually they are both the same size. The reason one appears tall and narrow, the other low and broad, lies in architectural lines that deceive the beholder's eyes

Do Your Eyes Tell You Lies?

How the tricks of vision can be used to make fat people look slimmer, big feet appear smaller, or to make your home and its rooms more attractive—Try these tests on yourself and see how your eyes can fool you

By Alon Bement

A FRIEND of mine, riding in the country with me the other day, was remarking on two houses set fairly close together by the roadside.

"I wonder," he said, "why the builders didn't make that first house low and broad like the second. See how tall and 'stiff' it looks."

I looked at the two houses and smiled.

"Those houses," I replied, "are identical in size. The difference lies in the eaves, the windows, the chimneys, and the small extension."

Of course he didn't believe me. I actually had to get out and prove to him by rough measurements made across the lot fronts that the houses were the same. It did seem impossible that putting half a dozen low shrubs around a house and cutting an extra sized window (so as to make your eyes run sideways to take in all the windows instead of having them appear as spots) and lengthening the eaves could make a stiff, prim house look so broad and cozy.

But I had studied how to trick the eye and I knew how easily it could be done. I had seen many curious principles put into practice in marine camouflage, principles that we never could have made work if the eye were not fairly easy to deceive. The fact is, the eye can be tricked much more easily and much more completely than the ear, perhaps because the organs of hearing develop earlier than those of sight.

When we are frightened, we instinctively stop and listen. In the dark your eyes are practically useless, but your ear keeps on working just the same. Even while you are asleep your ear keeps guard, a little drowsily perhaps, but awake enough to give you warning before any other sense will. Therefore, within the range of its proper functions, the ear is considerably more to be depended upon than the eye.

We often are not conscious of the defects of the eye until we begin to consider the matter seriously, but at a very early age we have learned to interpret the illusions that confront us almost without thinking about them.

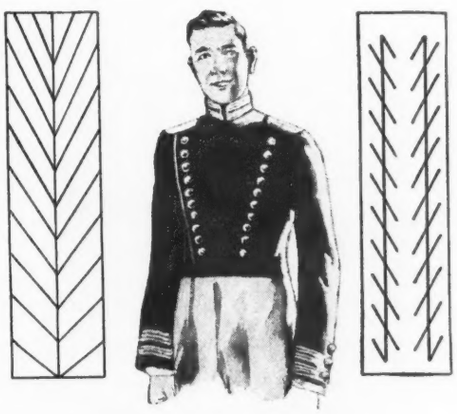
During the war, one of the earliest discoveries that we made was that we could reduce the visibility of objects on the land by painting them to resemble the objects about them, but when we tried to do the same with ships, we found that it wouldn't work.

The submarine had only to get the ship between it and the sun, and there you were—outlines as clear as anything. Besides that, the atmospheric conditions of the sea change so often and so greatly that you couldn't count on any given condition. You'd paint your vessel to be invisible in a green sea and the ocean would turn gray or purple.

AS IT didn't work, we had to try something else. The next time we went to the opposite extreme. We wanted the ships seen—the more vividly the better. The reason for this was that the submarines did not attack from a distance. When a submarine sighted a vessel, it remained on the surface long enough to get the size of the ship and her exact course, and having made its calculation on where the ship would be in 15 minutes, it submerged and headed under water for the place from which it could attack at close quarters.

We discovered that we could throw out the calculations of submarine pilots by deceiving them as to the direction the ship was taking. When we found that we

Professor Bement, a young American artist, is one of the world's foremost authorities on optical illusions. During the war he worked for the government in camouflaging American ships. He is now director of the School of Fine and Applied Arts of the Maryland Institute, Baltimore.



How Diagonal Lines Deceive

Fig. 1—Diagonal lines running upward make the rectangle at the left appear to taper toward the top. The perpendicular lines in the right-hand figure seem to converge toward the top, yet actually they are parallel. The same principle is applied in uniform to make the hips of the wearer appear narrower and, by force of comparison, his shoulders broader

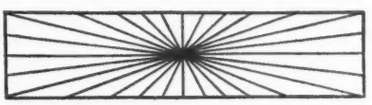
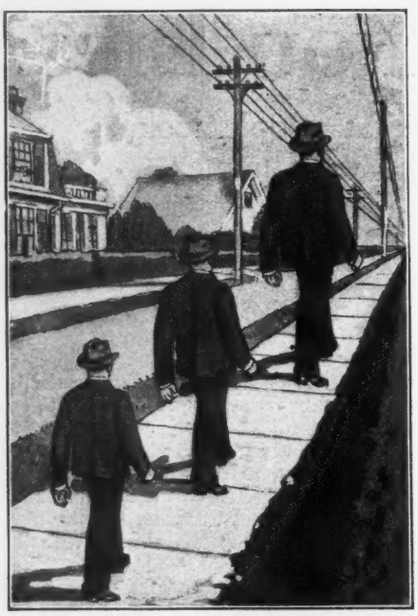


Fig. 2—Does the border of this rectangle look straight or curved? Here again the trick of diagonal lines makes the rectangle appear to bulge at the center and taper at the ends. Yet the outside lines are parallel

could conceal the true perspective of a vessel by the way we used lines, spots, and colors, we wanted the lines, spots, and colors to show up as brightly as possible. The submarine judged the course of a ship by its perspective lines. Wherever possible we distorted these lines; we pinched together or widened the natural lines at the bow or the stern, or made wide marks across them, so as to conceal the true shape of the ship and thus in the end make its speed and course difficult to compute.

SOMETIMES we tried to make them look long, sometimes short. The fast vessels we painted to look short and stubby, and we tried to make the slow freighters look as slim and fast as we could. As a result of this sort of camouflage a number of submarines, in the last



Which Man Is the Tallest?

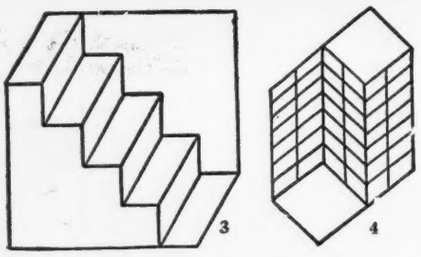
You'll find it hard to believe that these three men all are the same size. Yet if you measure them with a ruler, you'll find that they are. Your eyes are tricked by the fact that everything in the picture has been drawn in perspective except the three human figures

few months of the war, so miscalculated the speed and direction of vessels they were attacking, that they came up too close to them, and being unable to train their torpedoes fast enough were promptly run down or captured.

Just to see how effective it was, and how your eyes can be deceived, try out on yourself the surprising tests shown on these pages.

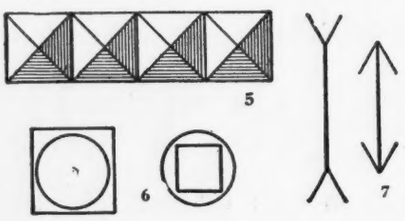
If you have any faith in your eyes, for example, Figs. 3 and 4 probably will remove the last vestige of it. Here are two striking examples of things that seem to change while you watch them.

Do you see the top side of steps in Fig. 3 going up, or the under side of steps going down? Look again. What do you see this time? Maybe you see just a design in black and white. Now, just what do you see in Fig. 4? Is there a solid block with the top toward you on the right, with a kind of wing and an open space or hollow at the left? Or do you see the solid to the left and the hollow space to the right? Or do you see two solids set at an angle to each other? Observe this solid



They Change before Your Eyes

Look closely at the steps in Fig. 3 for a moment or two. Suddenly you will see them turn upside down before your eyes. You will find that your eyes play the same amazing trick with the chimney-like object in Fig. 4



Do you see the pyramids in Fig. 5 pointing toward you or away from you? Watch them a moment. You will see them change while you look. Which circle in Fig. 6 looks larger? They're really the same size, surprising as it may seem. And in Fig. 7 does the perpendicular line at the left look longer than the one on the right? It isn't. They're the same length. Your eyes merely have been tricked by slanting lines, in one case pulling your sight beyond the ends of the line, in the other pulling your sight in toward the center

Legs that Fool You

You'll swear that one of these men is bow-legged, the other knock-kneed, won't you? Now hold the page on a level with your eyes and look along it from the bottom edge. You will see that all four legs are perfectly straight

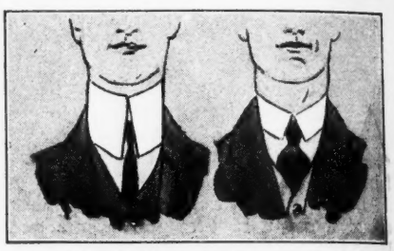
carefully. Does it seem to slip over to the other side while you are watching it? It is an odd sensation to see it change right before your eyes, is it not?

These are examples of what is called "ambiguous perspective," the principles of which we used during the war in painting ships. These curious coats of various colors were put on, not to render the ship invisible, but to deceive the enemy as to the size and shape and the course it was pursuing.

If you will hold your hand before you silhouetted against a bright area like a very bright sky, you will see, if you move it swiftly to the right, a bright line just behind its back edge, and outside that a dark shadow, a sort of a ghost of the hand itself.

IT TAKES a keen eye to see this phenomenon under the most favorable circumstances, but we are told that the light and pursuing shadow are always just behind any swiftly moving object. This is the reason we cannot see a really swift motion. The dark edge following gets confused with the real edge. The camera rarely reveals this, and that is one reason it can show things the eye cannot see. If the fast camera can eliminate this confusion of edges, there seems to be no reason why science may not one day hand us a pair of eyeglasses that will do the same. We have glasses to correct far sight and near sight. Why not glasses for swift sight?

You can be deceived just as easily with color as with line. If you take a deep red



Which Neck Looks Longer?

The man with a long neck usually seeks to make it look shorter by wearing a high collar. Actually the high collar makes it look longer. The necks in the picture are the same length

background, look at it for a while, then place strips of gray paper against it, the strips will appear a ghostly sort of green. On a blue surface your strips will look orange. Easier than that, try looking at a strong electric light for a few minutes, then look at a blank wall. You'll see the light exactly the same shape, but the color will be purple.

A BOOK on dress recently warned against wearing too much orange, because it gave blue shadows to the face. Primary colors—red, blue, yellow, green, orange, and purple—have a tendency to make us see their opposites. In other words, wherever you see one of these, its complement will be hanging around and you will catch glimpses of it now and then out of the tail of your eye.

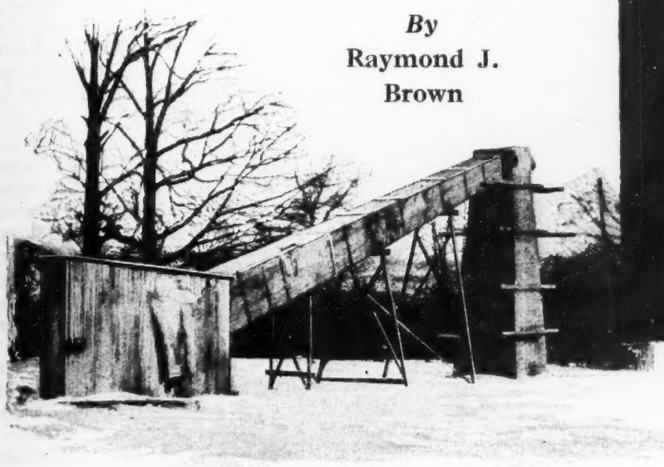
So, you see, your eyes can't be trusted. Things are not what they seem. At first it may appear rather a low trick for your eye to play you; but when you think about it, I believe you will agree with me that it is a fair arrangement. If the eye could not be tricked into making high spaces seem low, and broad ones slim, you would have to go on living with your imperfections. But with an understanding of the law of tricking the eye by subtle placements of lines and colors, it is pos-

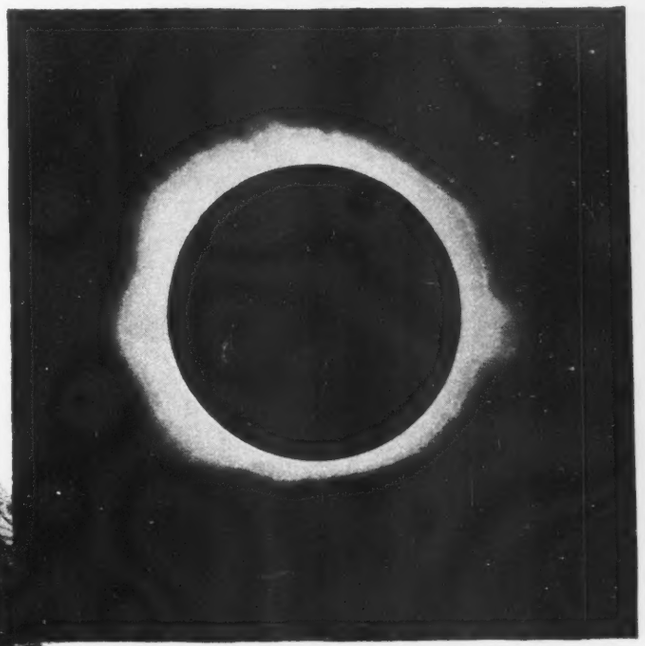
(Continued on page 145)

Why the Eclipse Was Late

How Science Is Adding, Little by Little, to Our Knowledge of the Sun

By
Raymond J. Brown





The Sun in Total Eclipse

A remarkable photograph of the eclipse of the sun January 24, made by the 62-foot camera (at left) of the Swarthmore College expedition at the Yale University observatory. It gives a spectacular view of the corona extending hundreds of thousands of miles into space. In the original photograph the diameter of the moon measured about 7¼ inches

ON LAST January 24 occurred what was in some respects the most remarkable eclipse of the sun in the history of the world.

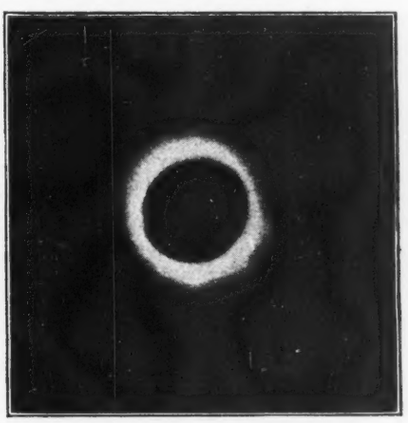
More people undoubtedly saw that eclipse than saw any previous one, for the reason that the path of the moon's shadow was across territory more thickly populated than any that the shadow ever had traversed. Likewise, in the path of totality stood a larger number of astronomical observatories than ever before were situated in the path of a single eclipse. Because of available conveniences of transportation, many American astronomers whose permanent stations lay outside the path of totality found it relatively easy to move their instruments and establish temporary stations at places from which the phenomenon would be visible in its entirety. Clear skies virtually throughout the path of totality facilitated observation of the eclipse in all its phases both to scientists and laymen.

Due to recent developments in the science of aerial photography, it was the first eclipse in history of which the world was assured of permanent photographic records no matter what the weather; for, if the day had been dull, airplanes could have ascended high above the clouds and the photographers snapped the hidden sun in the mistless light of the upper atmospheric strata.

ALSO, at least one entirely new and unique investigation was made when science seized the opportunity offered by the eclipse to study the mysterious effect of darkness on radio transmission and reception.

In short, Nature arranged and carried out the details of the eclipse like a master stage director, and supplied at one time a gorgeous spectacle for the layman and the means of making the complex observations through which astronomers have learned all that they know about the sun. The program was a little late in starting, but that was expected, because eclipses, for reasons that will be explained presently, never occur exactly on time; they always arrive a little later or a little earlier than the time predicted.

And so it would seem that with conditions so favorable this eclipse ought to have yielded a wealth of new scientific knowledge regarding the sun. Possibly it will. At the present writing, however, approximately a month after the eclipse, science has but little to report, the reason being that knowledge of the sun is wrung with almost incredible slowness and difficulty from the observations and photographs made at time of eclipse. In fact, the long and complicated calculations and measurements incidental to compiling the mass of data recently obtained scarcely have been begun.



Photographed from the Air

An airplane picture of totality made from a height of 18,000 feet by the Fairchild Aerial Camera Corporation. Note that the moon appears egg-shaped. This distortion is due to the fact that the airplane was moving rapidly when the photograph was made. If, however, the day had been cloudy, preventing ground cameras from snapping the spectacle, airplane pictures such as this would have been invaluable for astronomical study

Professor John A. Miller, director of the Sproul Observatory at Swarthmore College, Swarthmore, Pa., leader of an expedition that observed the eclipse from the grounds of the observatory at Yale University, New Haven, Conn., explained to the writer a few days ago why new knowledge of the sun is so rarely obtained.

"WHAT we know of the sun," he said, "is the cumulative results of thousands upon thousands of observations made during hundreds of eclipses and at other times. No one eclipse can be expected to yield results of a startling kind. As an example of the slow way in which things move with regard to the sun, take helium. This element was discovered in the corona of the sun during an eclipse in 1868. Almost 30 years passed before it was learned that helium was a terrestrial element also; and it is only now, a quarter of a century or so later, that man is finding a useful application of helium in the inflation of airships.

"There was no discovery made at the recent eclipse comparable in importance with the discovery of helium. Of that we are certain. Just what information of a really important nature the eclipse will yield we shall not know for months probably; years, perhaps; at least until we have completed the measurement of our photographic data and our calculations.

"Our photographs already have disclosed one fact of interest to the astronomer—namely, that although it is only 2½ years after the minimum sunspot period, the shape of the corona shows that

(*Continued on page 141*)

COLDS:

By Malcolm MacDonald

Why Colds Spread—Beware of Sneezes and Coughs

If you are in the path of a lusty sneeze such as this you are more likely to catch cold than if you are exposed to severe weather or get your feet wet. For the common cold is extremely contagious. The corpulent, overfed man in the rear, who apparently is the least concerned, is the one who probably is more susceptible to contagion than the thinner passengers

WHEN you have a cold—and most of us have one or more each year—do you blame the weather? Most of us do. Miserable and wretched, we speak harshly about the weather, stay indoors, and keep our feet dry.

Now wet feet are not to be recommended at any time, but reports of a recent survey undertaken by the United States Public Health Service indicate that we can no longer be sure of our ground when we blame the weather for a cold in the head or other nose and throat disorders.

This survey is the first effort of its kind to determine when, how often, and why, we suffer from colds, coughs, and allied ailments. The results seem to have upset a number of popular beliefs. Chief among these surprises is an indication that meteorological conditions, at least during the year studied, have little bearing on the prevalence of colds, bronchitis, influenza, sore throat, hay fever, and pneumonia.

This lack of relationship between colds and the weather in the United States is demonstrated in the startling similarity between cold-occurrence in the rigorous North and that in the warmer South and Pacific Coast. In general, New Orleans and San Francisco suffer with Chicago and Boston—and at very nearly the same time of the year.

THIS conclusion, reached by the Public Health Service, is based on reports of health conditions among representative groups of people in Massachusetts, Ohio, Illinois, Maryland, the District of Columbia, Louisiana, Montana, Utah, Arizona, and California, covering a period of a little more than a year.

That colds have their seasonal outbreaks is borne out by a study of these reports. The indications are, however, that colds are not most frequent in the heart of winter, but that in most sections under survey the highest prevalence of trouble comes in October. For all the centers embraced in the study the October "epidemic" was shown to be perhaps 20 per cent greater than the next highest ratio, reached in January.

During the latter half of October respiratory troubles appear to sweep from coast to coast, and from New England to the Gulf. During November and December the ratio declines, until the last days of the year show the average-line within hailing distance of the lowest point between October 1 and June 30. This comes at a season when Massachusetts is in the midst of a New England winter and New Orleans, La., Tucson, Ariz., and San Francisco, Calif., are living outdoors in the sunshine.

THUS do actual health records contradict our common beliefs about colds.

The new year starts with an outbreak of colds that begins late in December, finds its peak in the early days of January, and sharply recedes before the middle of the month. From this time forward to the end of June there is a steady decline in respiratory ailments.

The groups on which the figures of the Health Service are based may be regarded as being fairly representative of the entire population. For the greater portion the survey deals with college students, among whom more than 13,000 individuals were examined. College students are likely to be of the same general age. To offset this selective grouping, and to afford more intimate study of conditions in family life, the research also has embraced groups of families throughout the United States, with reports covering entire households, including

What Science Has Found Out about Colds

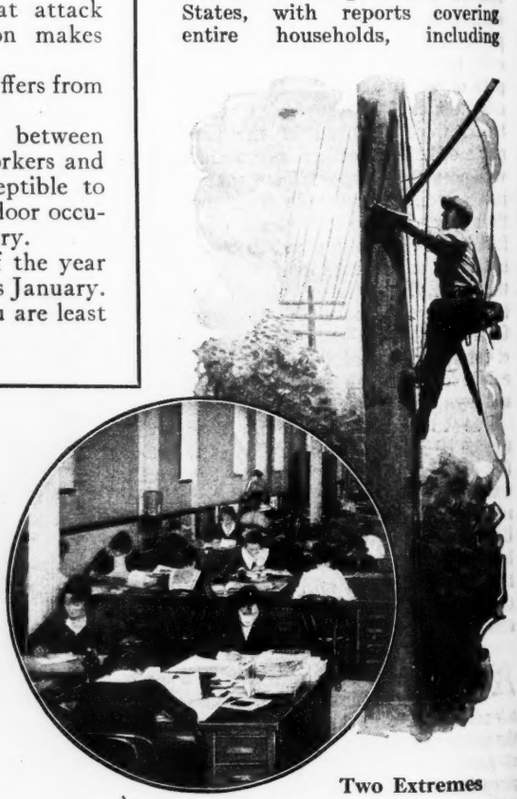
The common cold is extremely contagious.

It does not come from bad weather or wet feet, but from germs that attack those whose physical condition makes them susceptible.

Each of us, on an average, suffers from 3.7 colds a year.

Colds make no distinction between youth and age. But indoor workers and city dwellers seem more susceptible to them than those who have outdoor occupations or who live in the country.

October is the worst time of the year for colds. Another bad month is January. June is the month in which you are least likely to catch cold.



Two Extremes

Indoor workers are more likely to catch cold than those who, like the telephone lineman, work in the open air. The lineman, however, if subjected to the continued weakening effects of extreme exposure, becomes more susceptible to the much graver menace of pneumonia

How you get them, how to avoid them, and how to treat them. Vital new discoveries about this most common of man's ailments

servants. These latter groups included the families of medical officers of the army and navy, the medical and scientific personnel of the Public Health Service, and the faculty members of the selected colleges.

PRELIMINARY compilations of the investigation, which, by the way, is still in progress, show that in a fairly representative group there were few individuals who escaped colds during a period of 5½ months. The figures also disclose that only 10 per cent escaped colds entirely. In the period studied the individual cold average was 1.9. Should the same rate obtain throughout the year in the country, it means that if you have your share you will have 3.7 colds each year.

In the past there has been no basis for study of the prevalence of such minor ailments as the common cold. Such ailments are not included in the lists of diseases that must be reported to the local authorities. But by continued investigation the Public Health Service hopes to obtain much additional information as to the prevalence of respiratory ailments and their causes.

While the data so far gathered shows clearly that all sections suffer from numbers of common colds at about the same time of year, the outbreaks in New Orleans are entirely independent of those in Chicago, Boston, and San Francisco. Apparently there is no exchange of infection in these outbreaks. The attacks come relatively simultaneously.

Another phase of identity is found in the duration of illness. From north to south and from east to west the average length of disability for all respiratory disorders is slightly less than 6½ days.

Medical experts on the subject tell me that the common cold is no respecter of years, but comes to old and young alike. The same may be said concerning sex. Apparently boys and girls, men and women are equally susceptible.

When it comes to a comparison between town and country, there seems to be an advantage in favor of the person living away from the congested centers. The reasons are obvious. City houses are apt to be overheated. The evidence brought forward by medical observers tends to prove that where an indoor temperature of more than 70 degrees is maintained during cold weather, there is an increase in respiratory disorders.

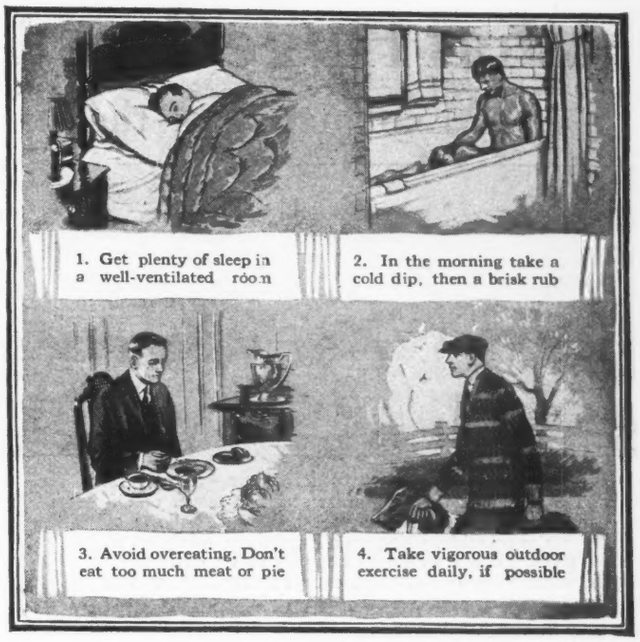
The reason for this is that in overheated rooms the relative humidity of the air, on which our health and comfort largely depend, is likely to be unusually low. "Relative humidity" means the amount of moisture in the air in comparison to the amount that the air could possibly hold. If the relative humidity of the room is 50 per cent, we understand by that that the air in the room has just half as much moisture in it as it could possibly hold at that particular temperature. Its ability to hold moisture increases as the temperature is increased.

IN THE wintertime the temperature of the outside air is very low, and consequently the amount of moisture in it is very low. When this dry air from the outside comes into the house, it is warmed. This makes it capable of holding much more moisture than is already in it. Consequently the relative humidity of the air in the home is very low.

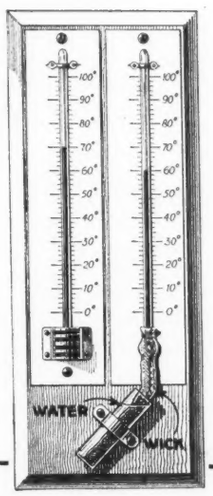
In many homes the air in the wintertime is drier than the air over a desert. The results are that the perspiration from our bodies evaporates very rapidly, making us cold, although the room is quite warm as far as the temperature is concerned. If the relative humidity of the home is between 50 and 60 per cent, a temperature of 68 degrees will be found very comfortable; while with dry air a temperature of from 70 to 75 is necessary for comfort.

This hot dry air is very irritating to the nerves and injurious to the eyes. It makes

(Continued on page 146)


1. Get plenty of sleep in a well-ventilated room
2. In the morning take a cold dip, then a brisk rub
3. Avoid overeating. Don't eat too much meat or pie
4. Take vigorous outdoor exercise daily, if possible

Four Ways to Avoid Catching Cold



Make Your Own Hygrometer

An efficient hygrometer, or wet and dry thermometer, with which you can determine the relative humidity of your rooms, can be made easily from two ordinary household thermometers, as shown in the illustration. Simply mount the thermometers on the same board and keep the bulb of one of them moist by means of a wick tied around the bulb and dipped into a small medicine vial filled with water. The table below will enable you to determine the humidity from the difference in the readings of the two thermometers. For healthful conditions the humidity should be above 50 per cent

How to Find Relative Humidity

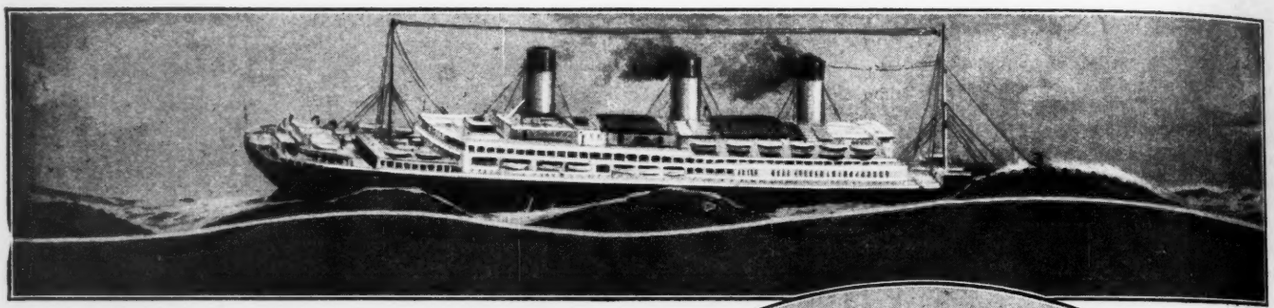
SUPPOSE the dry bulb reads 70 degrees and the wet bulb 60. The difference will be 10 degrees. Now run down the column that has the figure 10 at the top until you come to the horizontal column corresponding to a dry-bulb reading of 70. At this point the number is 56, the relative humidity.

Difference between dry and wet bulb thermometers

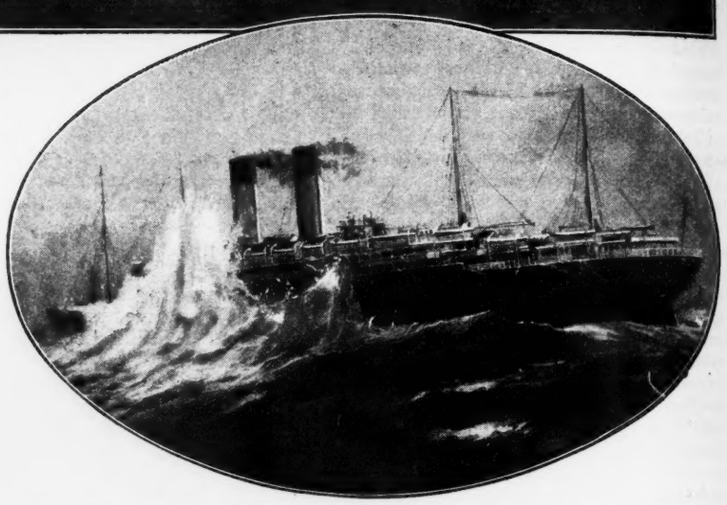
Dry Bulb	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
50	93	87	81	74	68	62	56	50	44	39	33	28	22	17	12
52	94	88	81	75	69	63	58	52	46	41	36	30	25	20	15
54	94	88	82	76	70	65	59	54	48	43	38	33	28	23	18
56	94	88	82	77	71	66	61	55	50	45	40	35	31	26	21
58	94	89	83	77	72	67	62	57	52	47	42	38	33	28	24
60	94	89	84	78	73	68	63	58	53	49	44	40	35	31	27
62	94	89	84	79	74	69	64	60	55	50	46	41	37	33	29
64	95	90	85	79	75	70	66	61	56	52	48	43	39	35	31
66	95	90	85	80	76	71	66	62	58	53	49	45	41	37	33
68	95	90	85	81	76	72	67	63	59	55	51	47	43	39	35
70	95	90	86	81	77	72	68	64	60	56	52	48	44	40	37
72	95	91	86	82	78	73	69	65	61	57	53	49	46	42	39
74	95	91	86	82	78	74	70	66	62	58	54	51	47	44	40
76	96	91	87	83	78	74	70	67	63	59	55	52	48	45	42
78	96	91	87	83	79	75	71	67	64	60	57	53	50	46	43
80	96	91	87	83	79	76	72	68	64	61	57	54	51	47	44

What Huge Seas Do to Ocean Liners

An Explanation of the Origin of Recent Giant Waves

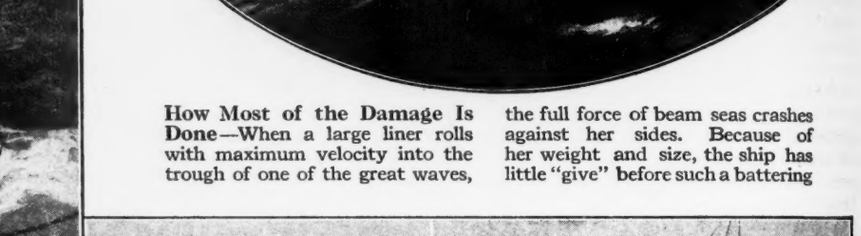


What Causes a Mountainous Wave—Lines 1, 2, and 3 represent three separate series of waves of different lengths. Occasionally the crests and hollows of the series coincide, piling up a huge wave, as shown at the right. If a liner's nose happens to be down when she encounters one of these exceptionally large waves, she takes the all-enveloping sea right over her bows

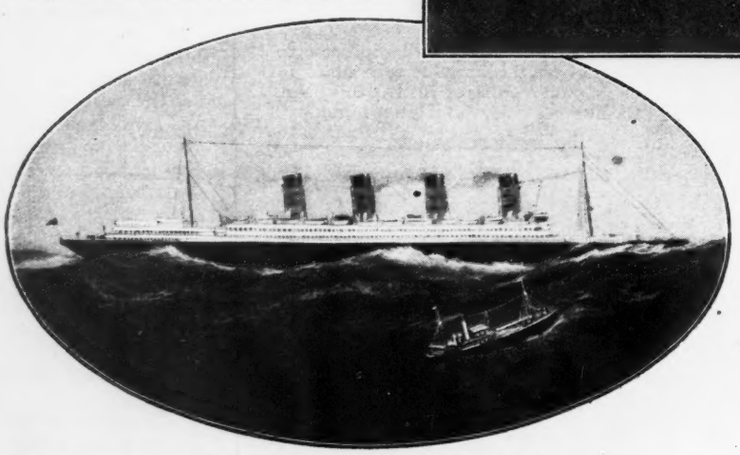


How Most of the Damage Is Done—When a large liner rolls with maximum velocity into the trough of one of the great waves, the full force of beam seas crashes against her sides. Because of her weight and size, the ship has little "give" before such a battering

A Dangerous Beam Sea—This picture shows what happens when a great liner, with nose down, rolls inward toward one of the huge waves caused by reason of three waves coinciding



Why the Big Ship Gets the Worst of It—A heavy wave strikes a big liner with greater force than it does a smaller ship, because the liner offers greater resistance. The smaller ship (at left) can "give" more to the sea, as indicated by the dotted lines



The Pitch of Ships—A long, heavy liner, pitching regularly, does not rise quickly to a heavy wave, with the result that a deluge of water occasionally pours over the bows. But a trawler, smallest of sea-going ships, quickly rises and falls over the crest of the wave

WHEN gales of cyclonic fury struck Atlantic shipping during the last two months, it was noticeable that some of the largest liners were the worst sufferers. Fittings were damaged, staterooms flooded, and passengers thrown about and injured. Even on the *Leviathan*, the world's largest ship, passengers were slightly hurt.

The average height of waves during an Atlantic gale, mariners say, is about 40 feet. How is it, then, that waves can rise to such a height as to damage the decks and fittings of liners often from 80 to 90 feet above the normal water line? By the aid of picture and line the artist, G. H. Davis, has given a graphic explanation.

The Inventors Who Speed YOUR MAIL

Marvelous Time-Saving Machines Devised by U. S. Postal Employees

By Norman C. McLoud

Twin Letter-Boxes

One of the boxes is for local letters, the other for domestic and foreign mail—a simple new idea that saves time in sorting at the post office

I WAS in the office of a New York business man on a Monday afternoon a few weeks ago while he was signing his day's correspondence.

"Here's a letter that must get to San Francisco by Saturday," he said. "I wonder if I ought to send it by air mail. No," he decided, "it will get there Friday night and be delivered on Saturday by ordinary mail."

And without another thought to the matter, he went on signing the remaining letters.

Most of us are like that man. We take the mails for granted. When we address a letter to a place two days' railway journey away, we mail it in entire confidence that it will be in the hands of the addressee at the end of the second day.

Few, I am sure, realize that the transfer of a piece of mail matter from one part of the United States to another is a process quite as complicated and quite as wonderful as is the process by which a song sung in a broadcasting station on the Atlantic Coast is hurled through the ether to be reproduced by the radio receiver owned by a man in Colorado. Few, too, I am sure, suspect that this seemingly simple process of mail transfer is accomplished largely through the agency of a vast number of ingenious mechanical devices that have been developed for that sole purpose. And it is only by the invention of these time-saving and labor-saving devices that the Post Office Department has been able to keep abreast of the tremendous pressure of modern business and industry. It permits no operation to be performed by human hands that can be performed more accurately, efficiently, and speedily by machinery.

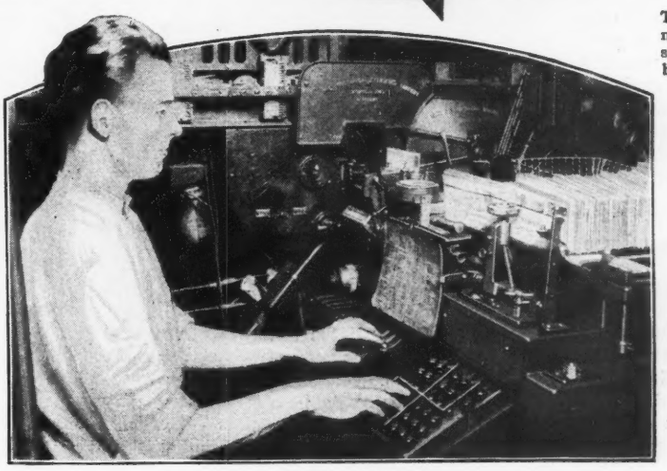
THE department maintains an Engineering Division that is charged with the responsibility of speeding the mails by means of improved practices and newly invented equipment. Congress encourages inventive genius within the postal service with a fund to provide cash rewards for employees who develop devices adopted by the department. As a result, some of the most valuable inventions that speed your letter to its destination have been developed by postal shop workers.

Take the "facing table," for an example. Every hour collectors in the crowded business sections of our large cities dump into post offices thousands upon thousands of letters. These are addressed to every corner of the earth; they are in many sizes; in bundles and separate. The envelopes face in every possible direction. Some are upside down. Others are crosswise and askew. And this chaotic mass must be put in order. Each letter must be started on the way to its destination without chance of error. To do this by hand would require an army of clerks, and even then might result in utter confusion.

Unscrambling the Mail

The "facing table" is one of the most ingenious of the new time-saving postal inventions. Letters by the thousands are dumped on a circular platform where clerks turn them right side up, then insert them in a slot. They emerge neatly packed in stacks according to size, each letter face up with the stamp in the right-hand corner, all ready for the cancelling machine

But the facing table has solved the problem. This device consists of two round platforms, the upper fixed, the lower revolving. The clerks work on the upper platform, which resembles a large dining-room table with a slot at the edge.

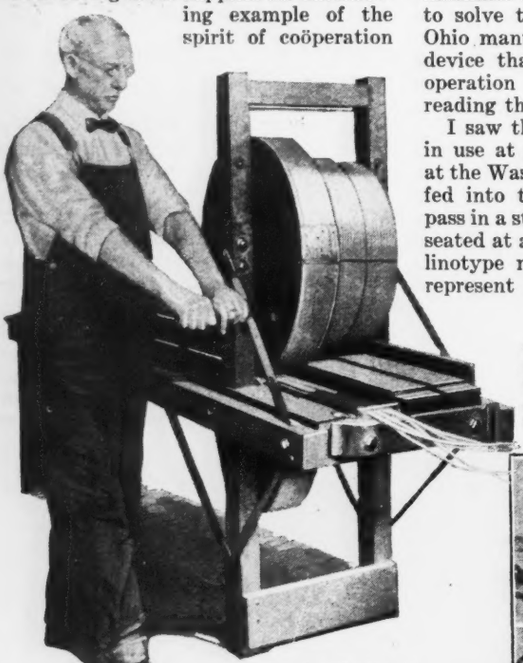


A Mechanical Sorter

As letters are fed mechanically into this remarkable machine, the operator simply notes the address of each and presses a corresponding key on a keyboard. The machine then automatically carries the letters to their proper pigeonholes

On this surface are dumped the letters. The clerks shuffle them about, turning them right side up, and drop them into the slot. The letters fall to the revolving platform, and are carried along to outlets at the far side of the table—long envelopes going into one channel, ordinary correspondence-size envelopes into another. They emerge neatly packed in stacks according to size, each letter face up and with the stamp in the upper right-hand corner, ready for the canceling machine.

This facing table supplies an outstanding example of the spirit of coöperation and loyalty that pervades the technical arm of the postal service. The necessity for such a device had been recognized. Employees of the Mail Equipment Shops attacked the problem and speedily produced the table.



Cord Cutter

J. D. Miller of the mail-equipment shops, operating the machine he invented for cutting 20 lengths of cord in one movement of a lever

Without this table the canceling machine, which in large post offices has superseded the old-time practice of canceling stamps by hand, would be entirely useless. A foreman in the Washington post office demonstrated this to me recently when he placed an armful of unsorted and unfaced dummy letters in the canceling machine. The envelopes emerged with the cancellation marks virtually every place on the letters except where they belonged.

THIS machine handles the normal run of letters—envelopes of various sizes and shapes—at a rate of 10 a second. Gas and telephone bills, or other consignments of mail matter of uniform size and shape, can be cancelled in this machine at the amazing speed of a thousand a minute.

However, these two machines do not solve the entire problem of getting the mail out on time. There still remains the highly difficult task of sorting the letters according to the destinations to which they are addressed. Virtually every collection in a big city brings in letters directed to every state in the Union and every country in the civilized world.

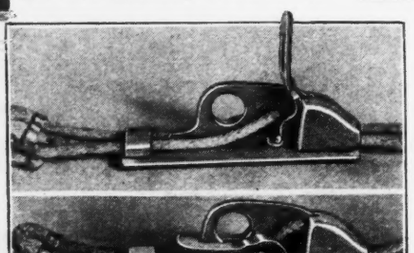
The established method of distributing outgoing mail has been by hand. Thus a clerk in the New York post office, for example, stands before a case containing about 60 pigeonholes, each marked with the name of some important city or geographical area, and tosses each letter into its proper niche.

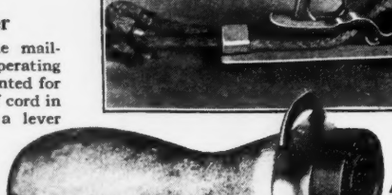
For years the postal authorities sought a better and more efficient way. Many machines invented for the purpose failed to solve the problem, until recently an Ohio manufacturing concern produced a device that literally can perform every operation of distributing mail except reading the addresses.

I saw this machine—there is only one in use at present—in operation recently at the Washington post office. Letters are fed into the machine mechanically and pass in a steady stream before an operator seated at a keyboard resembling that of a linotype machine, except that the keys represent geographical areas instead of the letters of the alphabet.

A Lock that Won't Slip

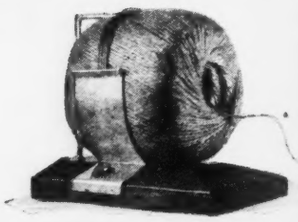
The problem of making a mailbag-cord lock that wouldn't slip was solved by Thornton L. Richardson with the lever attachment shown below. This clamps the cord securely from above





Cutter-Stamp

A combination cord cutter and stamp. The blade is on the side



Twine Holder

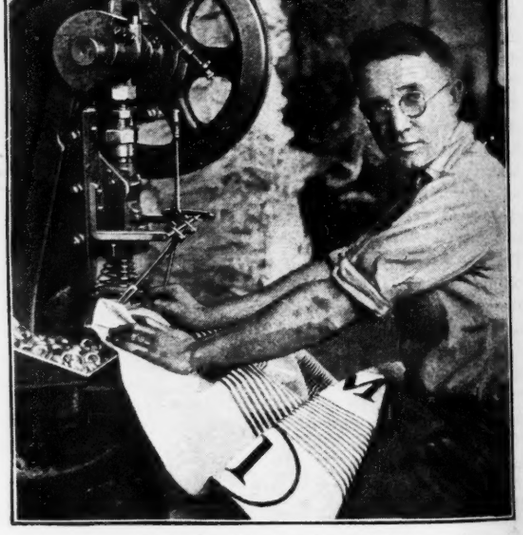
An ingenious postal worker saved the government considerable money by perfecting this holder that prevents loss of twine used in tying bundles of mail

As the operator notes the address of a letter, he presses the key that corresponds. The letter moves along in a container, and is picked up by one of a number of metal carriers on an endless chain. This conveyor carries the container over a series of pigeonholes, each a receptacle for mail for a particular place. When the letter reaches the pigeonhole for which it is intended, it is discharged into it. The pressing of the key sets a trigger on the container that is released only by the mechanism connected with the proper pigeonhole. There are 120 of the latter, twice as many as usually are contained in the cases used for hand distribution. This permits finer distinction in sorting and makes unnecessary a second sorting.

THESE inventions, of course, touch only one phase of the important operation of keeping the mails moving—handling incoming mail matter. Transporting the sorted mail to its destination is the next step. Here, too, the Post Office Department has made generous use of the gifts of science and the products of inventive minds, both in speeding the mail and safeguarding it in transit.

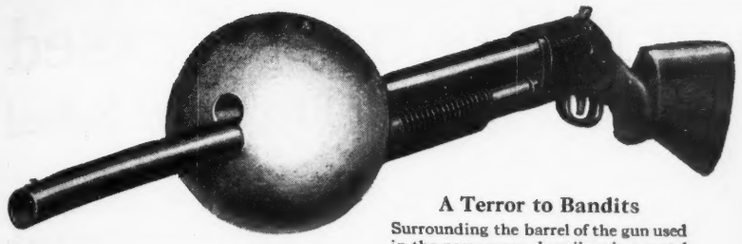
And speaking of safeguards, the Engineering Division has called on science to aid it in supplying protection against bandits. Recently there was put into service a bandit-proof railway mail car, a veritable fortress on wheels, equipped with ingenious devices to protect it against attack. Its walls, roof, and floor are armored like the sides of a battleship, entirely bullet-proof. It is equipped with portholes through which shotguns may be poked to repel an assault. Around the barrel of each gun is a metal ball, which, when the weapon is thrust through the porthole, closes the latter tight, and permits the gun to be swung through a wide angle.

In the portholes also may be placed magnesium candles, which will light the country for half a mile around and expose robbers to the bullets of marksmen within the car. Should a robber seek to escape the bright glare by diving beneath the car, he is subject to a rain of bullets from shotguns that project through the floor.



Simple Spring Device Saves Fingers

Before A. E. Wilde, a postal worker, invented this safety attachment for punch presses used in manufacturing mail-bags, 31 employees had lost fingers in the presses. His device—a spiral spring—has practically eliminated such accidents



A Terror to Bandits

Surrounding the barrel of the gun used in the new armored mailcar is a metal ball. This closes the porthole tightly when the gun barrel is thrust through

Beneath the car are metal cones that scatter bullets in all directions. Numbers of cars of this type probably will be constructed in the near future.

Minor inventions issue from the Mail Equipment Shops almost daily. One of the most striking of these devices recently developed is a non-crushable mailbag. The bag, light and wieldy, does not owe its durability to transverse bracing, as might be suspected. The secret lies in reinforcing it with a quarter-inch of "plymetal," a newly invented material that absorbs all weight and shock, distributing them through the length and breadth of the bag.

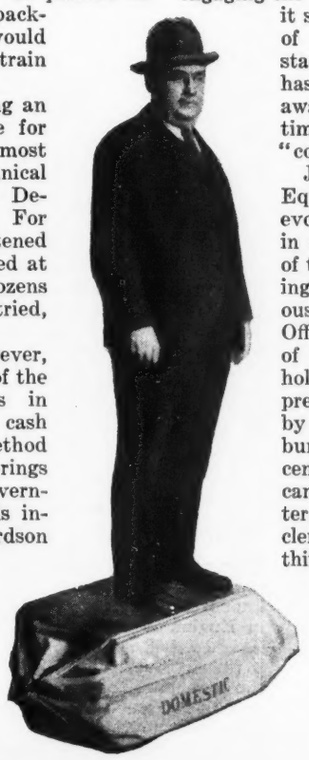
Repelling an Attack

In the rôle of robbers, a gang of postal clerks recently staged a realistic hold-up to test the efficiency of the new bandit-proof railway mailcar. The photograph at the left shows them surrounding the car, while a riot gun barks from a porthole in its armor. Within the car a mail clerk, shielded by bullet-proof steel, thrusts the muzzle of his gun through a porthole and sweeps the approaches. In the portholes also may be placed magnesium candles to light the surroundings and expose the bandits to the bullets of the marksmen inside of the car

TO PROVE to me that the bag will supply protection to fragile articles in transit S. W. Farnsworth, Chief of the Engineering Division, placed several empty pasteboard shoe boxes in one, and then had a 200-pound postal employee stand on it. The boxes came out just as they had gone in. Because the bags are flat and compact, many of them may be packed on one car, thus permitting packages that ordinarily would have to wait for the next train to go forward.

The problem of devising an effective fastening device for mailbags was one of the most troublesome that the technical men of the Post Office Department ever faced. For years, bags had been fastened by a cord lock that slipped at annoying moments. Dozens of substitutes had been tried, only to be discarded.

A few months ago, however, Thornton L. Richardson of the Mail Equipment Shops in Washington received a cash award for devising a method for bending tumbler springs for mailbag locks. The government's recognition of this invention inspired Richardson to tackle the fastener problem. As the result, he invented a lever attachment that clamps the cord lock from above, engaging the cord lengthwise and holding it secure under any conditions of use. His device is now standard equipment, and he has received his second cash award of a few months, this time for doing a thing that "couldn't be done."



He Can't Crush It

To test the protective quality of a newly developed non-crushable mailbag, a 200-pound postal employee stood on the top of one of the bags containing just two empty shoe boxes. The boxes remained undented by the weight

J. D. Miller, of the Mail Equipment Shops, recently evolved a simple machine that in one motion cuts 20 lengths of the cord required for fastening mailbags. Another ingenious employee saved the Post Office Department a large sum of money by perfecting a holder that keeps in place and prevents loss of the twine used by carriers and clerks in tying bundles of mail. And a recently devised combination canceling stamp and cord cutter, to be used by post office clerks in opening bundles, is a third clerk's contribution to the movement of the mails.

Sometimes there is an element of humor in these inventions by postal workers as, for example, when Tony Lombardi devised a "jig" whereby he doubled the amount of work he could do in operating a machine for reaming keyholes in mailbag locks. Tony kept his invention to himself, fearing he might be discharged for daring to make an unwarranted improvement on a government machine. It was not until his superiors noticed how much more work he was turning out than any other man in the shop that his device came to light. Then, to Tony's utter astonishment, he received a cash award, a citation from the Postmaster-General, and his "jig" was made standard equipment.

ONLY a short time ago, another cash award was made to A. E. Wilde of the Mail Equipment Shops, for a safety attachment for the punch presses used in the manufacture of mailbags. Before this attachment—a spiral spring that warns the operator of the drop of the punch—was installed, 31 employees had lost their fingers in the presses. Since the adoption of the device there have been few accidents in that department.

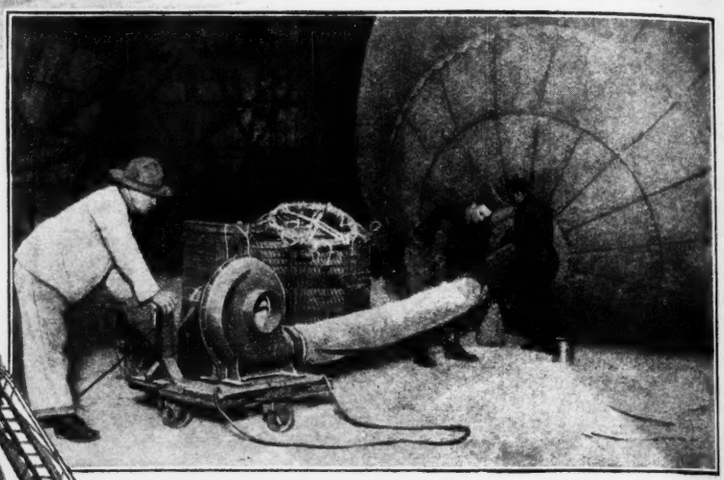
Airplanes, motor-trucks, and even caterpillar tractors, are carrying the mails today to people in remote sections. For every letter and every package that is deposited in a mailbox must go forward to its destination without delay. That is the creed of the Post Office Department, and storms, ice, snow, and countless other agencies seem to conspire to prevent its being carried out. Against these opposing forces the postal authorities have marshaled the powers of modern science.

New Milestones Passed

How Problems of Flight Are Solved

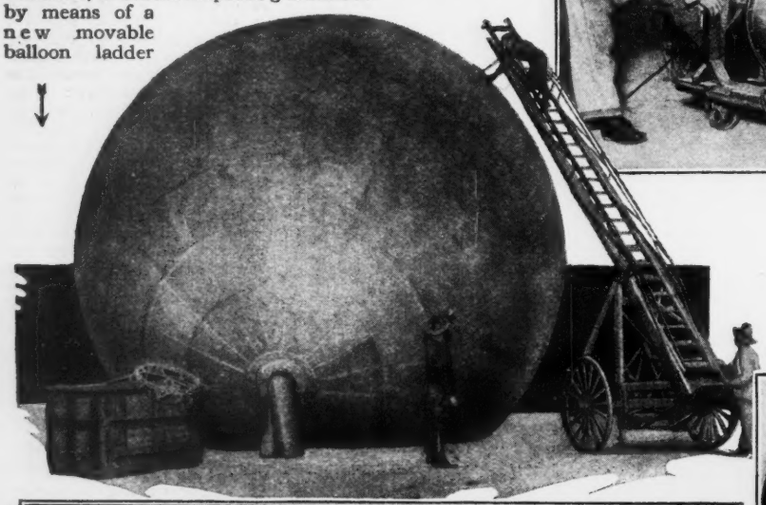
Aero-Skiing—A New Sport

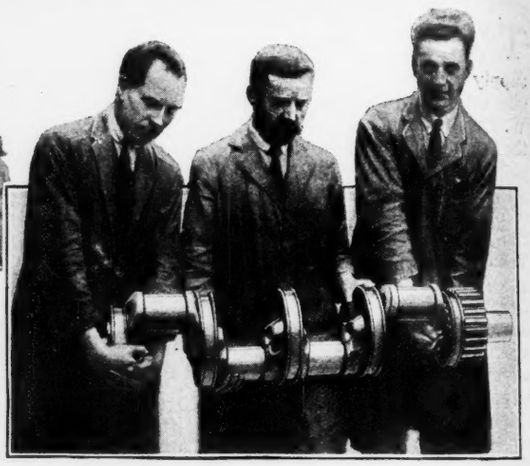
Skimming the ice at 90 miles an hour in a wingless airplane mounted on skis is a thrilling new sport devised by an ingenious aviator of Quebec Province, Can.



Preparing Balloons for Flight

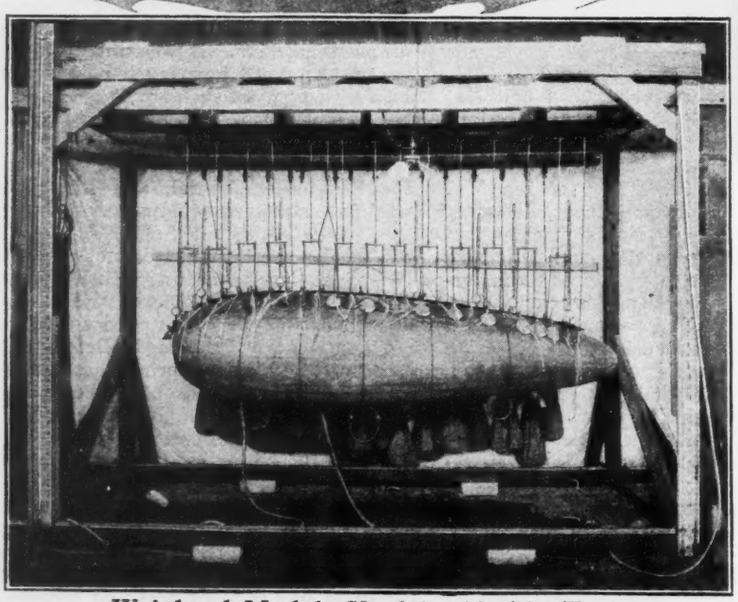
Ross Field, Arcadia, Calif., recently has become the scene of important developments in balloon navigation by army experts. At the right a balloon capable of soaring seven miles above the earth is being inflated preparatory to flight. Below, Lieut. C. P. Kane, commandant, is shown inspecting a balloon by means of a new movable balloon ladder





Huge Crankshaft

Three men are needed to lift the crankshaft of the world's largest aircraft engine, the Napier "Cub," completed recently at Acton, England. This motor weighs more than a ton and develops 1200 horsepower. A locomotive of the same power would weigh 75 tons



Weighted Models Used in Airship Tests

A novel test for lighter-than-air craft was developed recently by army engineers at McCook Field, Dayton, Ohio. A model of the ship is suspended from a rack and filled with water. Then weights are hung below. Aeronautical experts are able to determine from the behavior of the model exactly how the actual machine will react in the air to the various strains and stresses to which a flight would submit it

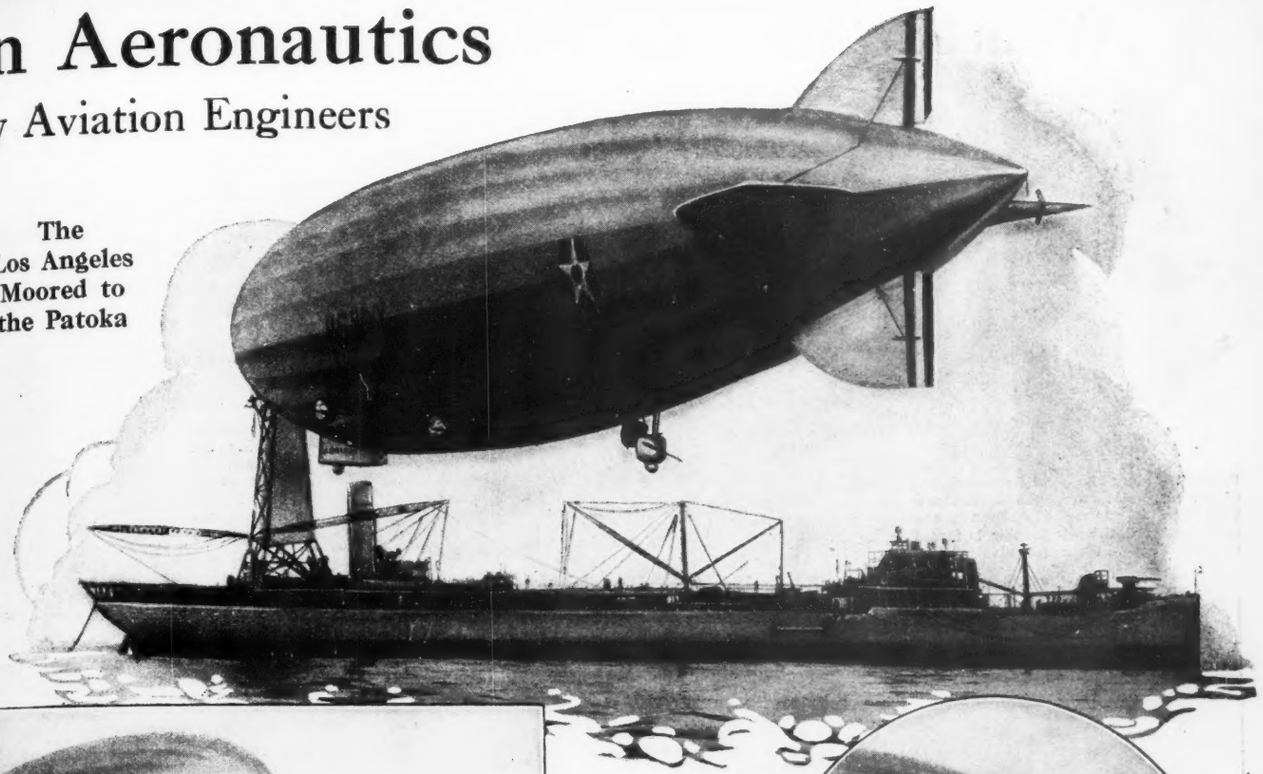
New Parachute

A new type of airplane parachute, worn like a knapsack, is under test in England. The release cord is attached to the airplane, causing the parachute to open automatically when the wearer must jump

in Aeronautics

by Aviation Engineers

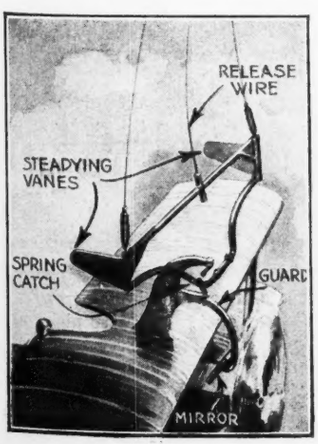
The Los Angeles Moored to the Patoka



Above is seen the great dirigible *Los Angeles* under tow for the first time by U. S. S. *Patoka*, the only ship in the navy equipped with a mooring - mast. This test took place recently in Chesapeake Bay and, like previous tests between the *Patoka* and the *Shenandoah*, was entirely successful

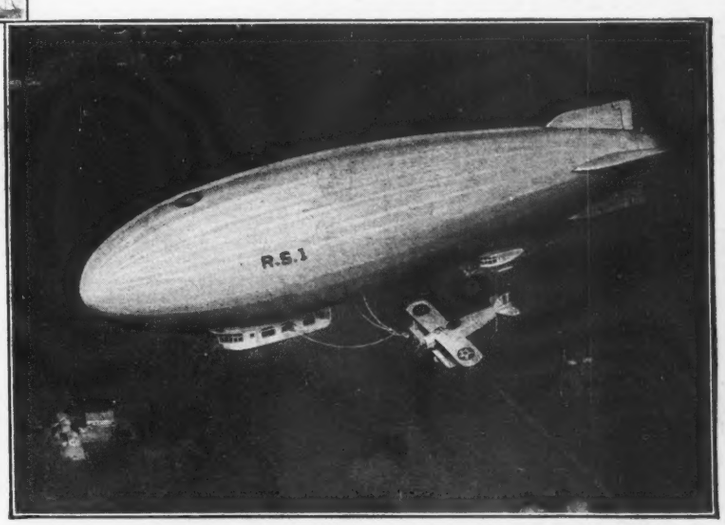
The *Los Angeles* remained moored for 45 minutes while the *Patoka* steamed up the bay. Then storm warnings caused the dirigible to return to her hangar at Lakehurst, N. J.

Effecting a contact between a dirigible and a mooring ship is a difficult and complicated operation. Here the *Los Angeles* is shown being hauled by cable toward the ship's mooring-mast



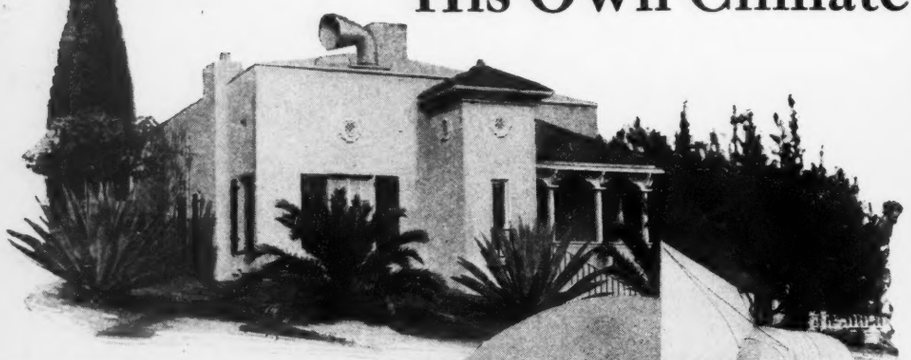
Plane-Catcher

How England purposes to enable the dirigible R-101 to pick up airplanes in flight. Guided by a mirror, the pilot maneuvers his plane until a spring catch on the wing engages a special cable device lowered from the airship

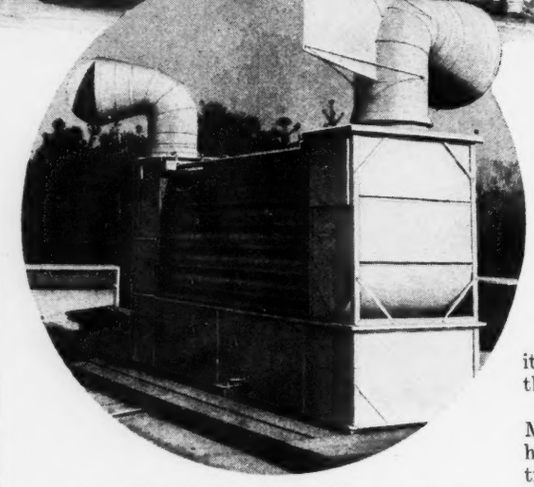


Artist's conception of the RS-1, the first semi-rigid dirigible ever constructed in this country, now being assembled at Belleville, Ill. This ship will be able to launch scout planes and pick them up again

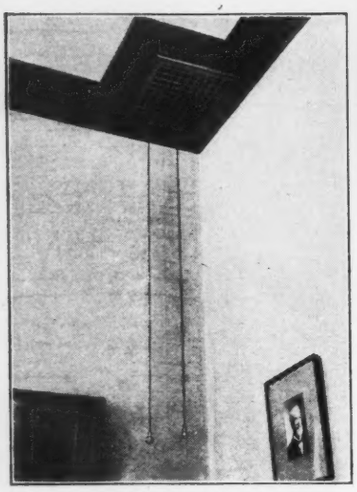
Weather Man Makes His Own Climate



Professor Moore's home with air-purifying device on roof is shown above. A closer view (at right) shows the two funnels, one turned toward the wind. Air is forced through water in the large metal box



The inventor comparing the percentage of humidity of the air out of doors with that inside the house



Air enters through unobtrusive ceiling registers. The amount of air admitted can be regulated by pulling the cords that can be seen above hanging from the register

AS CHIEF of the United States Weather Bureau in Washington from 1895 to 1913, Prof. Willis Luther Moore studied weather and climate closely. He was especially interested in humidity. When he built a home in Pasadena, Calif., recently, he installed in it a unique system of ventilation.

On his roof he built a water-cooling device for humidifying and purifying the air. A large intake funnel is faced to the wind by means of a weather-vane. Air from this funnel is forced through water and thence carried to all rooms of the house through ventilation pipes. A smaller funnel, which carries off the used air, is faced away from the wind.

Each room has two ventilators in its ceiling. One admits the fresh air and the other takes off the impure air.

In one test of the system Professor Moore found that with an outside humidity of 41 per cent the inside registration was 74 per cent. The percentage can be regulated to suit the convenience of the dwellers, he says. The system is applicable to any climate. With proper furnace control and a means of regulating humidity, such as this system affords, ideal home climate is possible in any weather.

Physicians agree that high relative humidity in the atmosphere of a home is of vital importance in preserving health.

Actors Radio Play to Deaf

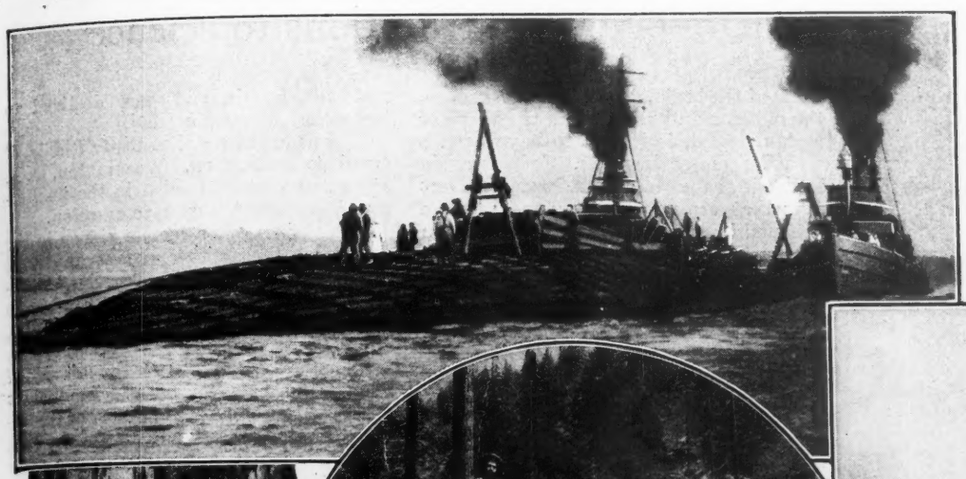
ONE hundred deaf persons, who could not have heard a word without mechanical help, were guests recently at an unusual theater party in New York City. Installed in various parts of the theater was an adaptation of the public-address system that speakers use when addressing huge crowds.

A scene in the play heard by a deaf audience. The microphone is concealed. At right: Persons in the audience equipped with head phones

The system consisted of microphones on the stage to pick up every sound, a vacuum-tube amplifier and 100 sets of head phones for those more seriously deaf. The listeners, to whom a play had been nothing more than a "movie" previously, reported that they heard every word. They are hopeful that the experiment will open the doors of the theater to thousands to whom, until now, they have been closed.

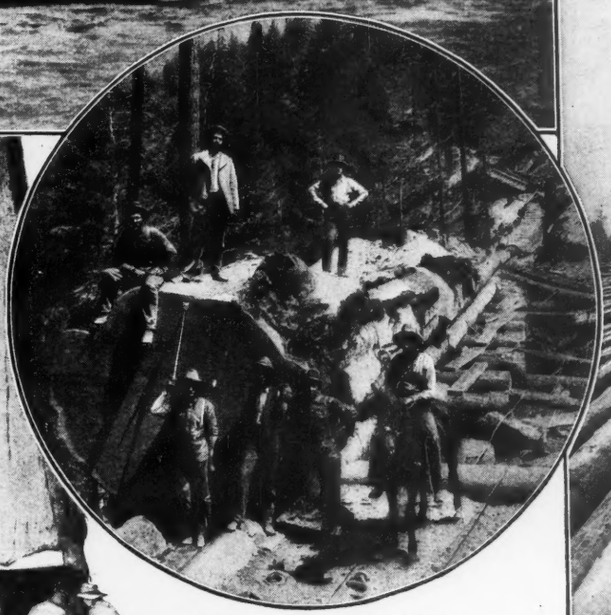
Where the Big Trees Crash Down

The Mechanics of Lumbering—A Dramatic Story in Pictures



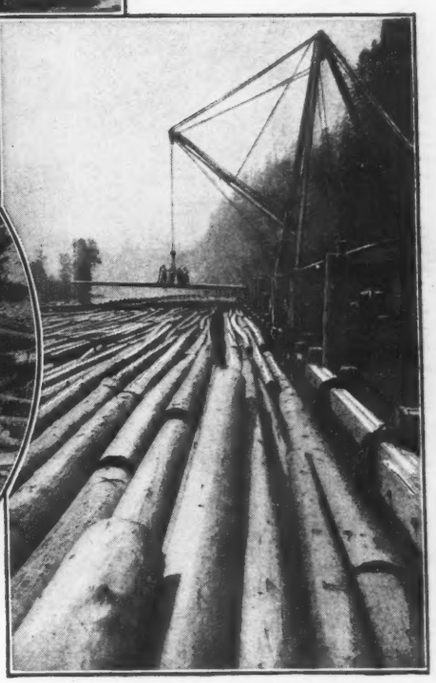
Largest Timber Raft

Large-scale operations by which timber is being shorn from our forests are pictured here. The timber raft at the left is said to have been the largest ever constructed, containing more than 5,000,000,000 feet of logs. It was towed 1000 miles from the Columbia, Ore., to San Diego, Calif.



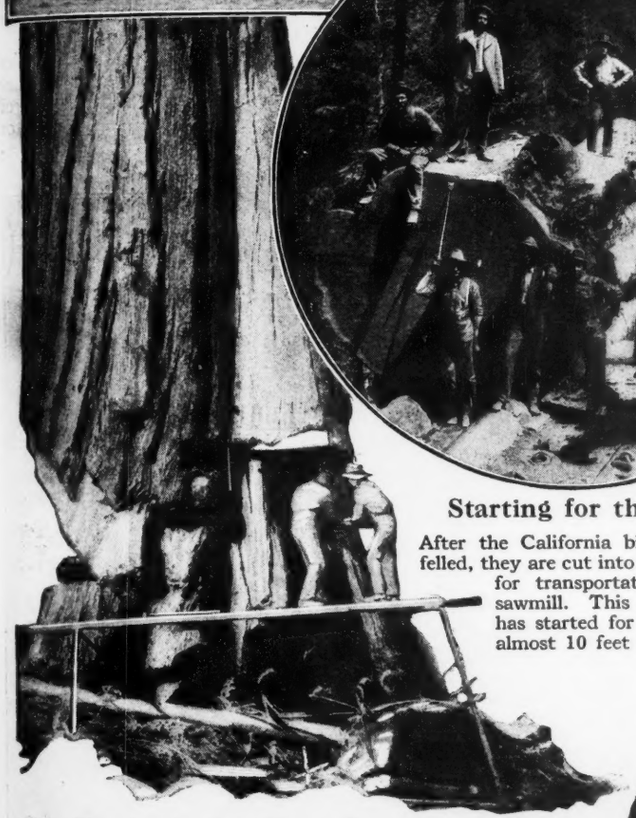
Starting for the Mill

After the California big trees are felled, they are cut into mill lengths for transportation to the sawmill. This tree, which has started for the mill, is almost 10 feet in diameter



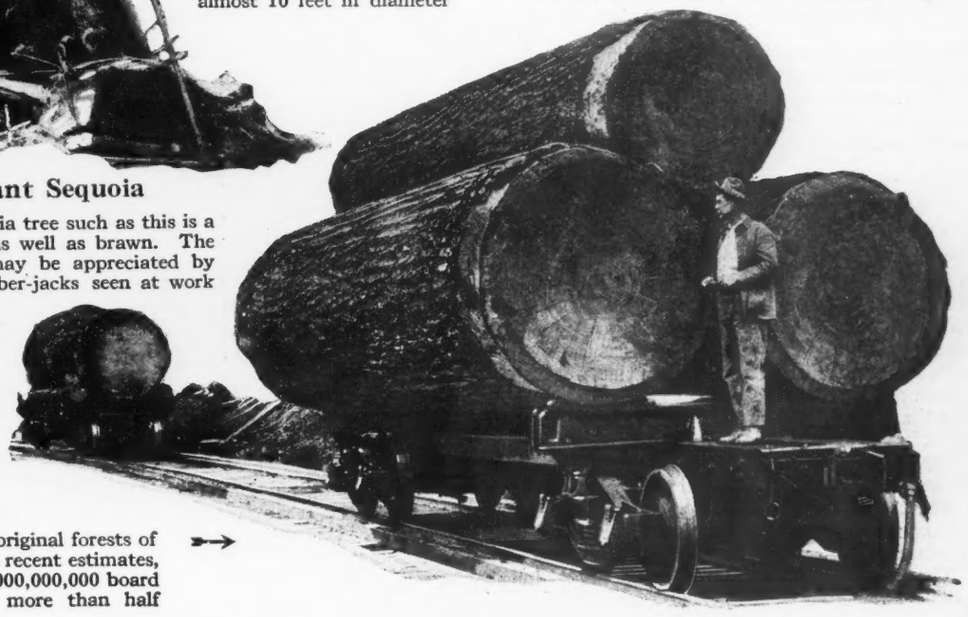
A Raft 720 Feet Long

This huge cradle raft of Douglas fir, shown under construction on the Columbia River at Stella, Wash., is 720 feet long. The logs, held by the cradle, form an immense barge



The End of a Giant Sequoia

Felling a giant California sequoia tree such as this is a task that requires great skill as well as brawn. The enormous girth of this tree may be appreciated by comparison with the two lumber-jacks seen at work



From Forest to Mill

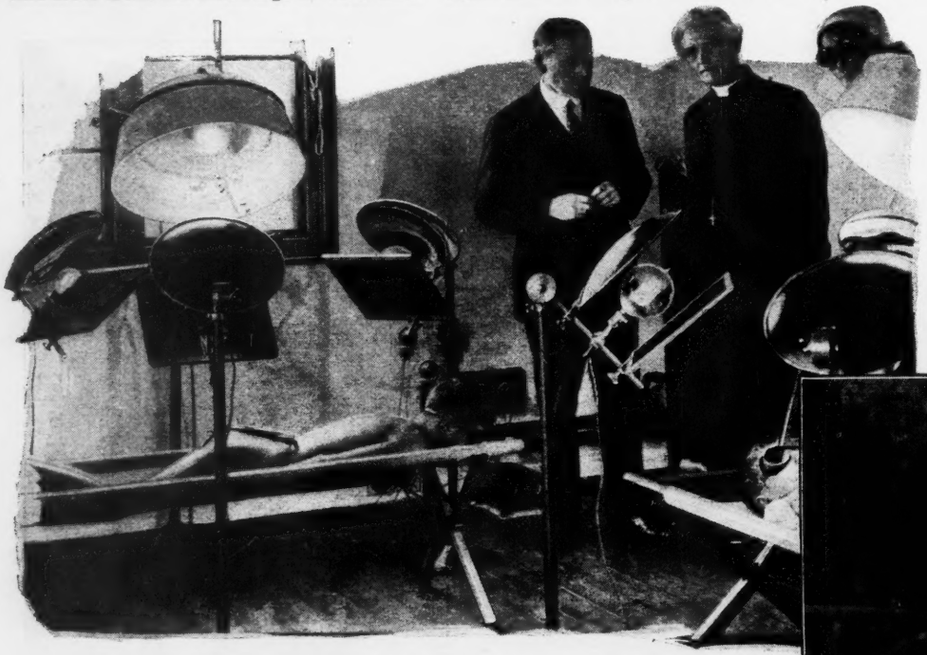
Piled on flat cars, these great logs are shown on their way from Washington forests to the sawmill. So the big trees are disappearing rapidly. The original forests of the United States, according to recent estimates, have been reduced from 5,200,000,000,000 board feet to 2,200,000,000,000, or more than half

The "Missing Link" at Last?

Discovery of ape-man's skull may prove theory that Africa is the birthplace of man—New contributions to science

IN THOUSANDS of research laboratories, in countless shops, in the fields, forests, mines—even in the farthest corners of the earth—the workers of science are on the job every day for you. The volume of their achievements in making your life more enjoyable and freer from the sufferings of want and disease is far beyond recording. Some of them remain forever unknown to fame.

On these pages are simply a few of the month's most important contributions to the world's useful scientific knowledge.



Natural and Artificial Sunlight Combined in New Treatment

The beneficial effect of ultra-violet rays, or artificial sunlight, in the prevention of disease, especially of rickets among children, has been demonstrated repeatedly by American and European scientists during the last year. Now the U. S. Bureau of Standards has determined by tests just completed that as a germ-killer the ultra-violet ray acts almost instantaneously. Bacteria of the kind found in sewage were killed in less than a second after exposure to the rays. The above photograph shows Dr. Murray Levick, a British pioneer in the use of sunlight for healing, demonstrating his new apparatus for combining natural and artificial sun rays in the treatment of children. Note how reflectors are placed above the patient

Ape-Man's Skull Found

DESCRIBED as the long sought "missing link," a skull found recently at Taungs in South Africa, is considered by some scientists as the most important anthropological discovery ever made. The skull is that of a creature with an intelligence rated between that of a man and an ape, filling in the important gap that so long has proved a stumbling-block in the explanation of evolution.

Professor Raymond Dart, the noted Australian scientist, who found the skull in a limestone mine, has named the creature linking men with apes, "Australopithecus Africanus."

The difference between men and animals is associated with the size of certain parts of the brain. The Pithecanthropus, the oldest man known, from the shape of a skull found, is judged to have been a creature who could speak. Judging again from the shape of its skull, Professor Dart says that the newly discovered manlike ape could not yet speak, but had a brain much more developed than that of an ape. That is, the brain was enlarged in those parts associated with human characteristics.

The skeleton remains consist of two fragments. One is a brain cast, which is complete and whole. The other is the face of the skull, which was found completely embedded in the limestone of an old cavern.

An interesting feature is that the discovery seems to support Darwin's belief that Africa was probably the original home of the human family.

Can Sex Change?

SCIENCE always has held that sex was a matter determined at the very beginning of life by certain cell structures known as chromosomes; that long before birth the expected arrival was fated to be either male or female and was destined to remain so throughout life.

Recently, though, Dr. Oscar Riddle, of Carnegie Institution, Washington, D.C., suggested that this belief in the unalterable fixity of sex is open to question.

Some years ago a female pigeon in the Carnegie Institution's laboratory at Cold Spring Harbor, N. Y., developed a disease that caused the degeneration of its sex gland, female birds having but one. This gland was on the left side of the pigeon's body. In a short time a male gland began to develop on the right side of the bird, and before long the pigeon actually had turned into a male.

Experiments performed by Doctor Riddle and others on other pigeons indicated that the sex of birds might be changed more or less readily. It was noted, more-

Mammoth Flower Shows Amazing Growth

Studying the amazing growth of this titanic flower, called "amorphophallus," botanists recently discovered that it reaches the height of eight feet in a little more than a month. The plant is a native of Sumatra. When the blossom is full blown it has an extremely unpleasant smell. Its full magnificence lasts for only three days, when it collapses. The photograph is reproduced by courtesy of Mr. P. Dakkus, who is curator of the Botanical Gardens at Buitenzorg, Java

over that male glands developed on the right side much more than on the left.

From these experiments sex changes have been brought about long after birth. Doctor Riddle suggests not only that the sex of an animal may not be the unchangeable thing it always was believed to be, but that, depending on the sex, the degree of sexuality is greater on one side of the body than on the other.

Supporting this new suggestion that the difference between the sexes actually hangs on a most slender thread are experiments recently conducted by Prof. Frank R. Lillie at the University of Chicago. By a simple gland operation, performed on several hens when young, he has caused them to acquire virtually all the characteristics of male birds.

New Antiseptic Stronger than Carbolic Acid

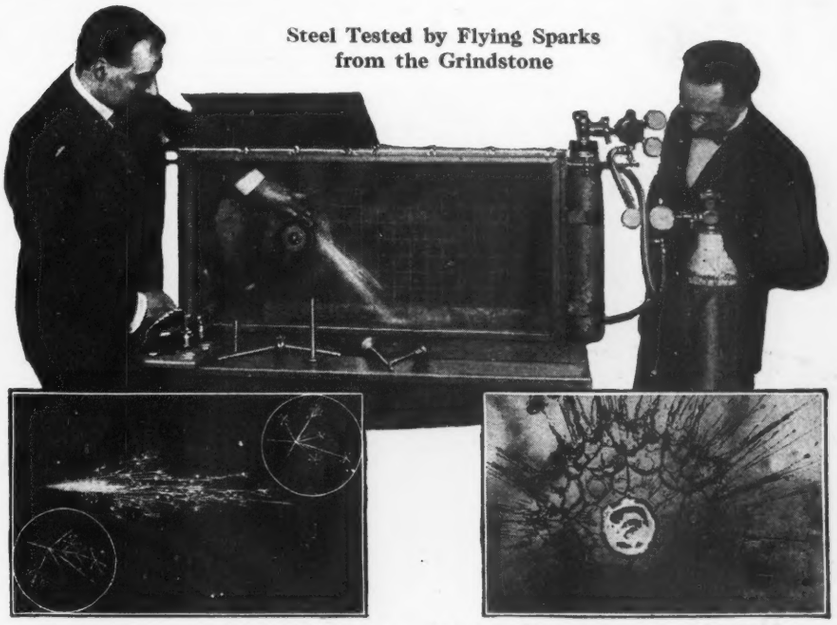
MEDICAL men long have dreamed of discovering some universal antiseptic which, taken internally, would destroy all the disease germs in the body, providing virtually a panacea for human diseases. Now this dream seems closer to fulfilment with the recent development of a marvelous germicide, said to be 50 times more powerful than carbolic acid, yet so harmless that quantities of it may be swallowed without injury.

The discoverer of the new antiseptic, called "hexylresorcinol," is Dr. Veader Leonard, Chairman of the Clinical Committee on Antiseptics of the National Research Council. He and his associates spent 10 years in developing it in the Johns Hopkins School of Hygiene and Public Health, Baltimore, Md.

In the experiments the antiseptic was first fed to rabbits. When the animals suffered no ill effects, Doctor Leonard and the six men working with him took it in increasing doses, and eventually were convinced that it was harmless. It was then that hexylresorcinol was successfully applied at Johns Hopkins Hospital for the treatment of patients suffering from infections of the kidneys and of the urinary tract. In some cases, kidney infections of long standing were cleared up in 48 hours, according to the hospital records. The cures appeared to be permanent, it was said.

To determine just how far-reaching may be the application of hexylresorcinol to disease in general, a committee of 15 scientists has been appointed by the National Research Council to work with Doctor Leonard in further research.

Steel Tested by Flying Sparks from the Grindstone



Photographs of sparks flying from metal on a grindstone are employed in a new and exact method of testing steel invented by E. Pitois, a French aeronautical engineer. By this method, he claims, even the amateur can determine the degree of hardness and purity.

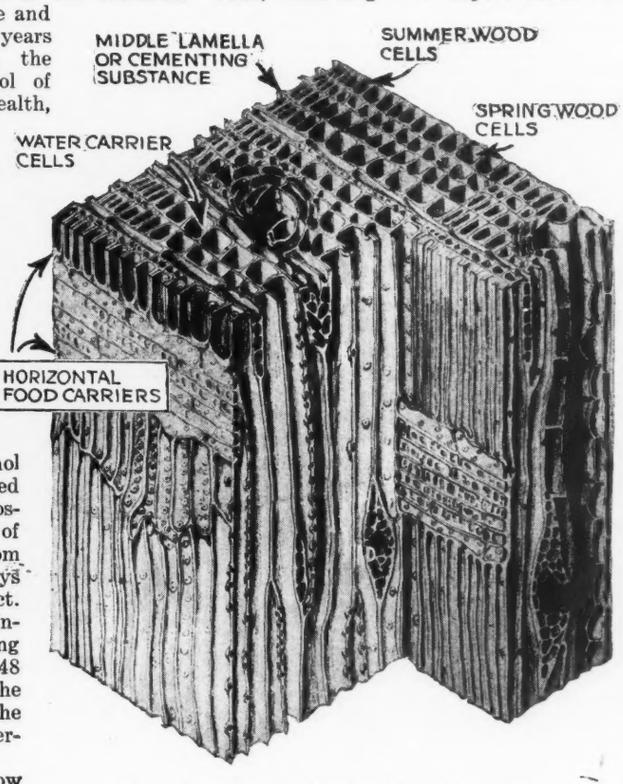
Sparks are photographed on a black background at very close range, and the images thus obtained are enlarged, revealing distinguishing formations that are said to determine the metal's quality. The pictures show the new apparatus and spark photographs

Niagara's Wasted Power

TWO and a half million horsepower are constantly going to waste at Niagara Falls, according to a report made recently by Samuel S. Wyer, associate in mineral technology of the Smithsonian Institution. This represents 87,800 cubic feet of water, which flows over the falls every second and which might be diverted for power purposes, he states, without marring the scenic beauty of the falls.

The total volume of water flowing over the American and Canadian Falls is 205,000 cubic feet a second, of which 94 per cent is carried by the Canadian side. At present 56,000 feet is diverted for water power and 11,200 cubic feet feeds the Chicago Drainage Canal, the Welland Ship Canal, and the New York State Barge Canal. This leaves 137,800 cubic feet, of which, Mr. Wyer maintains, only 50,000 is needed for scenic beauty. The remainder, he states, may be "harnessed."

Further water-power projects at Niagara Falls are impossible under the present treaty with Canada, which limits the amount of water that can be diverted for this purpose to 56,000 cubic feet, producing about 1,000,000 horsepower.



Secrets of Wood Disclosed by Microscope

This remarkable diagram of the cell structure of a block of white pine wood, recently produced with the aid of a microscope, reveals that wood, instead of being relatively solid, is really composed of many tubular cells cemented together. The walls of the vertical cells, which are water carriers, form the bulk of the wood substance. Running at right angles to them are horizontal cells that store and distribute food material. Spring wood cells that form during the early growing season, and summer wood cells produced toward the end of the season, together form one of the annual rings by which the age of the tree is told

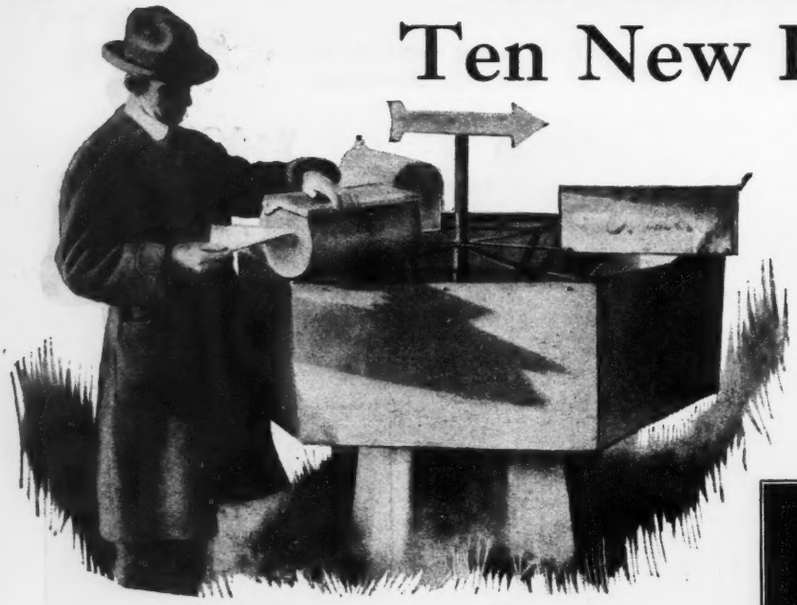
The Work Your Eyes Do

MOST of us realize the importance of good eyesight; few, though, probably know to what extent we employ our vision in our daily work. In a recent test conducted by a commercial concern studying problems in illumination it was determined that the ordinary run of indoor workers—clerks, machinists, printers and the like—use their eyes 70 per cent of the time they are at work.

Among 20 occupations that may be classed as "close work" it was found that in only six did the necessity for close visual application fall below 50 per cent of the working day.

The object of this eyesight test was to determine how much the production of workers may be increased by better illumination without placing an undue tax on their eyes.

Ten New Inventions for



Rural Mailbox Stand Revolves

A REVOLVING metal stand, holding from two to 12 mailboxes, saves space and time for the postman delivering rural mail near Livermore, Calif.

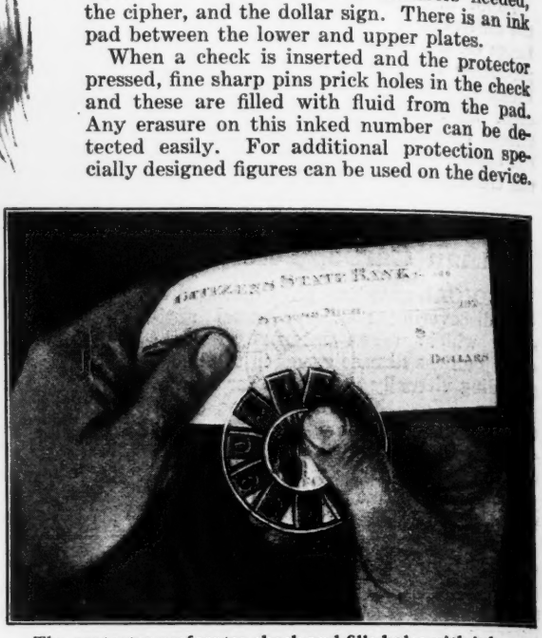
In order to do away with unsightly rows of individual mailboxes set on posts at crossroads, groups of farmers in many communities fix their mailboxes to large discarded wagon wheels set on the ends of fence posts. The newly invented metal stand serves the same purpose and helps to keep the highway more attractive.

The sides of the device can be used for posting small local notices. Mounted at the top of the center post on which the supporting frame revolves is a small road sign in the form of an arrow.

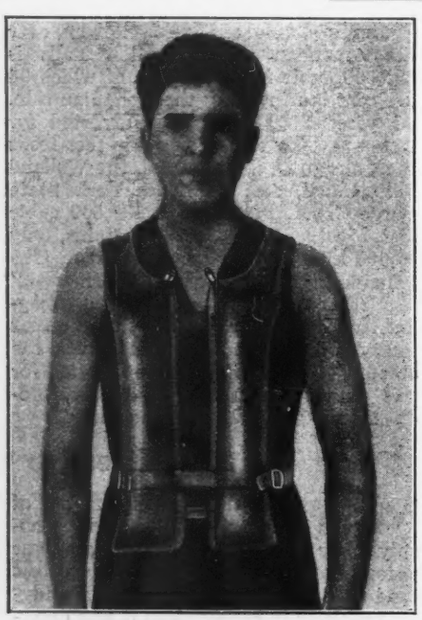
Pocket Check Protector

A CHECK protector, small enough to be carried in the vest pocket, is a recent invention for the convenience of business men who are careful to prevent raising of their checks. It includes all the numbers needed, the cipher, and the dollar sign. There is an ink pad between the lower and upper plates.

When a check is inserted and the protector pressed, fine sharp pins prick holes in the check and these are filled with fluid from the pad. Any erasure on this inked number can be detected easily. For additional protection specially designed figures can be used on the device.



The protector perforates check and fills holes with ink



Inflated Safety Belt for Bathers Fits Tightly

WEIGHING little more than a pound, this inflated safety belt for bathers fits over the shoulders and straps securely around the body. It has four large air chambers, two in front and two in back, with vulcanized seams.

Once adjusted, it cannot come loose, the manufacturers claim, and it interferes in no way with the movements of the bather. An air valve controls the inflation.

AN ELECTRICAL process for manufacturing carbon black, a pigment widely used for such purposes as printer's ink and carbon paper, recently has been devised by the U. S. Bureau of Mines. The present process uses natural gas.

This Novel Fire Alarm Rings the Door-Bell

ONE of the latest fire-alarm devices is connected with the electric door-bell circuit of a house, so that if a fire starts, it sends out a warning by ringing the bell.

In the photograph below the alarm is being tested with a lighted cigarette. Within from 30 to 60 seconds after the heat is applied, the inventor claims it will start the door-bell ringing.

A cigarette sets off the fire alarm

New Voltage Tester Tells the Kind of Current

TO TELL whether an electric current is alternating or direct, as well as to measure its voltage, this new type of voltage tester has been designed. It does not require the use of lamps and will measure up to 550 volts. The apparatus is inclosed in a rugged fiber housing.

Testing voltage from a light socket

A magnet coil operates a plunger against the tension of a spiral spring. The position of this plunger on a scale indicates the voltage. Pointed hooks in fiber-insulated handles at the end of long wires make it easy to get the lead wires into the circuit.

The photograph shows the device being used to test the current from an ordinary electric-light socket.

Our Every-Day Use

Typewriters Silenced

TYPEWRITERS fastened to desks with newly invented shock-absorbing attachments are said to become practically noiseless and rattle-proof, thus saving wear on the machine as well as on the nerves of office workers.

The rubber feet of the typewriter fit into sockets of the attachments, where they rest on felt-covered coilsprings. The machine is held firmly by automatic hooks that engage the frame as the legs are inserted in the sockets, and is released simply by pressing back the hooks.

Parts underneath the machine remain accessible for cleaning or repairs.

How the typewriter legs rest on four shock absorbers

A Push Opens New Typewriter Desk

A SLIGHT push brings the platform of this new typewriter desk into position. The lid is raised halfway before the typewriter platform moves, then a straight push backward brings the typewriter into place, making the operation easier and simpler, it is claimed, than that of the ordinary drop-head typewriter desk. The platform locks automatically into position.

Rigid supports prevent the platform from shaking, and ample knee room is provided for the operator, whether the desk is open or closed.

Special Pen Marks Packing Cases with Ink

ADDRESSES and marks made with crayon or pencil on packing cases and bales often rub off so that they are illegible. Much more permanent marks may be put on with ink, it is claimed, with a special pen invented recently for that purpose.

The marking pen is held upright

The flow of ink depends upon the pressure on the rubber nib. Any good ink may be used. The writer uses it like an ordinary pen, but holds it a little straighter. The pen can be used, also, for writing display cards or window signs.

A JOURNEYMAN baker in Paris, France, claims to have discovered a formula for bread dough that will keep the loaves in edible condition for months, or even for years.

MAKING synthetic rubber has resulted recently in the discovery of a synthetic chemical substitute for cocaine. Tutokain, the new compound, is made from the intermediate products. It is said to be effective as a local anesthetic.

Self-Feeding Brush Aids in Cleaning Type

TO DO away with the rather mussy method of cleaning typewriter type with brush and pin, a self-feeding typewriter brush has been designed. It consists of a hollow metal handle containing type-cleaning fluid, which is fed into an adjustable bristle brush. The fluid is applied by pressing a pump button.

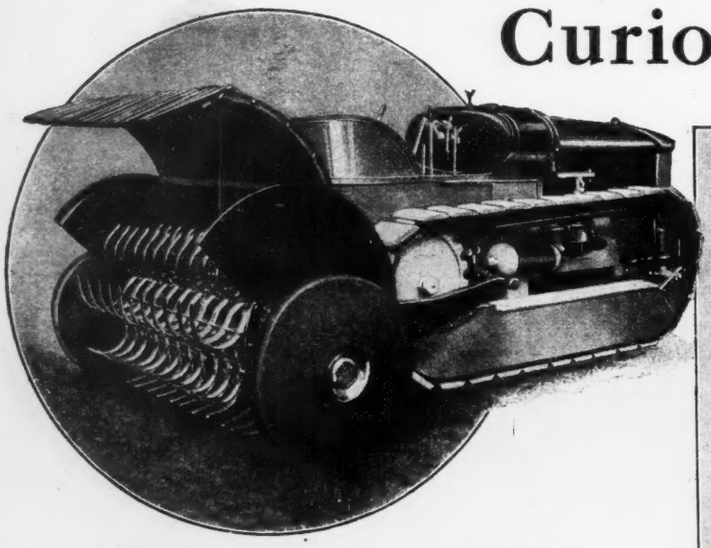
A typewriter brush shaped like a pencil

Combination Lock Invented for House Doors

THIS ingenious door lock works like the combination of a safe. The key is inserted permanently in the lock, which has a set of buttons around its outer edge. It can be turned only when the proper set of buttons has been depressed.

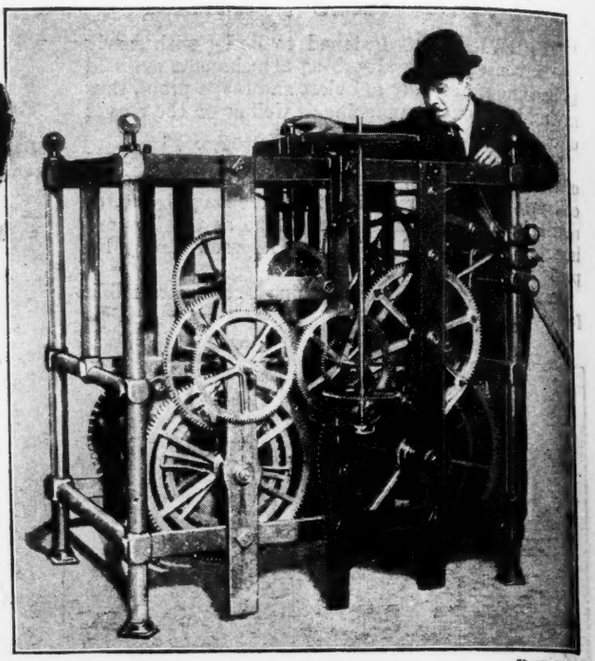
To bring the buttons back to their original position, the key is pulled outward after the door is opened, and the lock is again ready for service.

Curious, Useful and



Caterpillar Tractor and Plow Combined

One of the most compact farm implements exhibited at a recent German motor show was this tank-plow, said to be the first machine to combine caterpillar tractor and plow in one unit



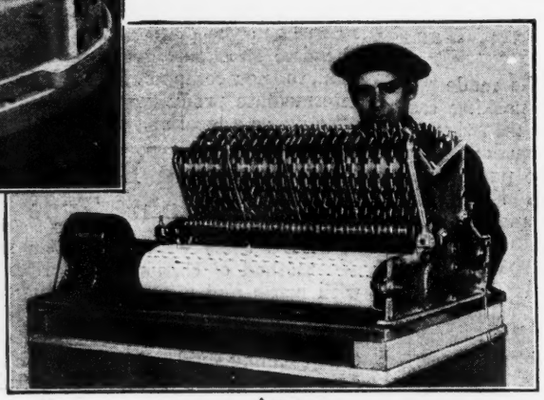
© U. & U.

These Wheels Have Run Nearly a Century

For nearly a century these clock wheels have been keeping good time. The clock was built in 1828 by Isaiah Quimby Lukens, and for nearly 50 years recorded time in Independence Hall, Philadelphia. It was remounted recently in the attractive new town hall at Germantown, Pa.

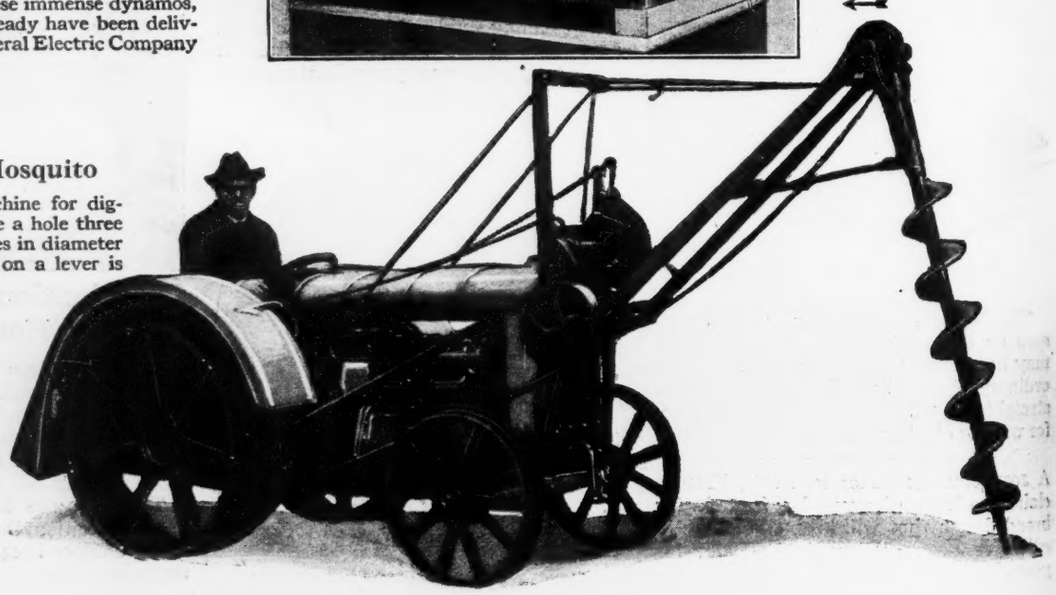
Mammoth Dynamos for Russia

There is room for a fair-sized switch engine within the stator of one of the huge generators comprising a new power plant that is to supply the city of Leningrad, Russia, with light and power. Four of these immense dynamos, each of 11,000 volts, already have been delivered by the Swedish General Electric Company



A Machine that "Thinks"

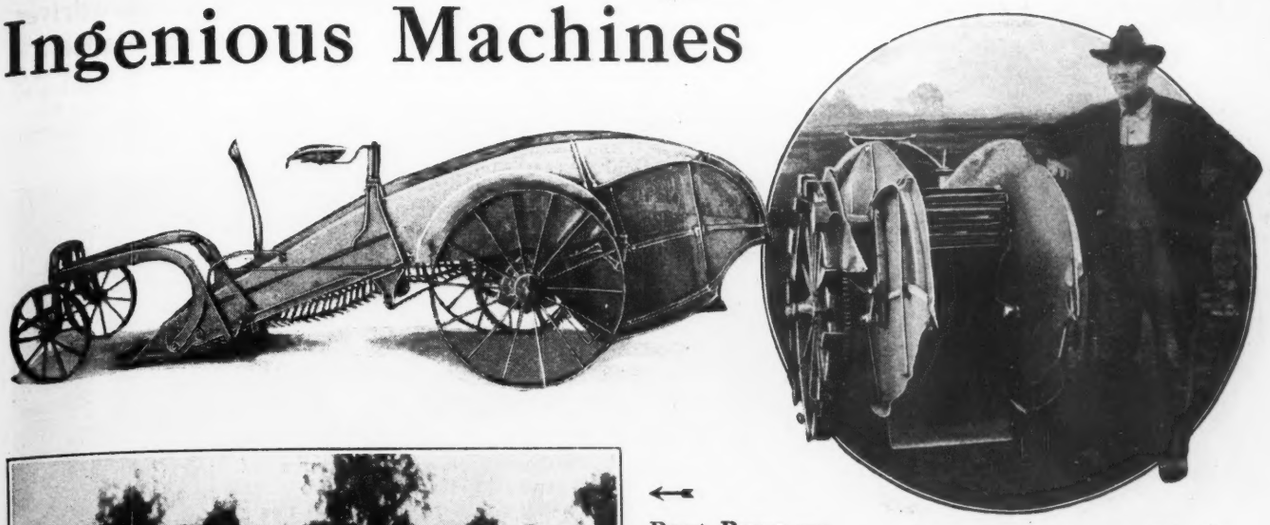
If you ever have tried to score an automobile race, you will appreciate the complexity of a new machine that keeps an accurate printed record of each speeding car and supplies a complete analysis of the contest



Like a Huge Mosquito

A remarkable new machine for digging post holes can bore a hole three feet deep and nine inches in diameter in 30 seconds. A pull on a lever is sufficient to start the drill downward. Another pull stops it at the desired depth and brings it back to the starting point. The inventor, Otto Coil, of Washington Court House, Ohio, built his original model from 23 pieces of farm machinery

Ingenious Machines

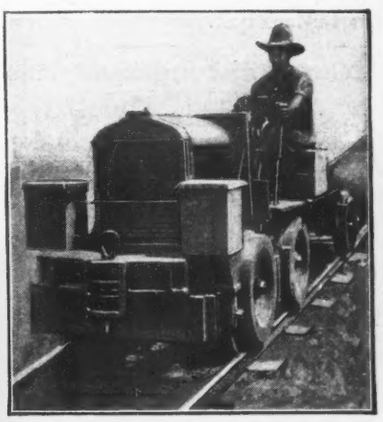


Boat Runs on Rails

One of the world's queerest boats, when it reaches land, climbs out of the water on rails and propels itself like a train on a track to its dock many feet from the shore line. It launches itself in a similar manner. This strange land-water craft is in daily service at Helsingfors, Finland's capital

Automatic Potato Digger

An improved labor-saving machine for the farm is a mechanical potato digger equipped with a revolving automatic dump that discharges the potatoes in windrows, convenient for the pickers to put in baskets. Side and rear views are shown in the illustrations above

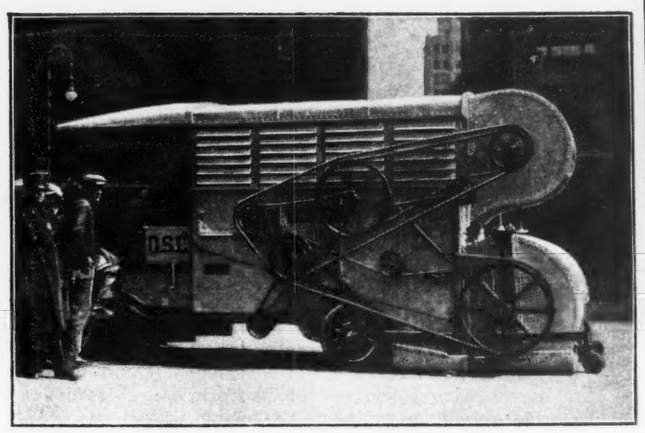


A Gasoline Locomotive

For heavy duty hauling service such as is required for mines, brick plants, and road construction jobs, an economical gasoline locomotive—a tractor on rails—has been perfected. It consumes about five gallons of gasoline a day

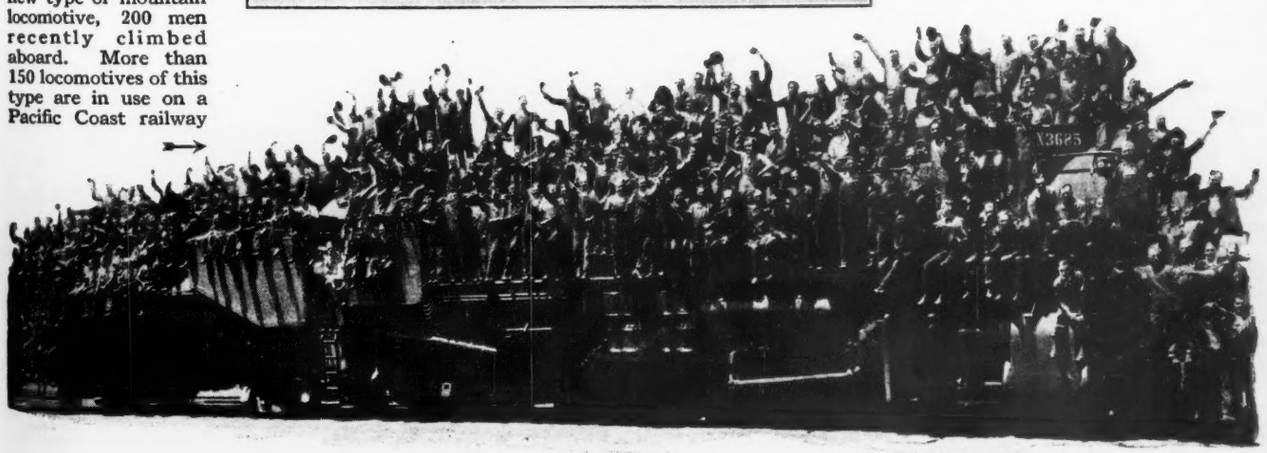
Vacuums Streets

The most modern of house-cleaning methods now is being applied to sweeping city streets. This mammoth vacuum cleaner recently invented, sucks up litter without raising dust, and sweeps without water



200 Aboard

Just to demonstrate the immense proportions of a powerful new type of mountain locomotive, 200 men recently climbed aboard. More than 150 locomotives of this type are in use on a Pacific Coast railway



Electric Handsaw Has Many Uses

A carpenter using the electric saw on the job

A NEW portable electric circular saw enables workmen to do power sawing on the job with speed and accuracy. It is said to cut satisfactorily wood, wallboard, plaster board, fiber, linoleum, hard rubber, insulated cables, brass, and many other materials. It can be used also in the packing industry for cutting meat.

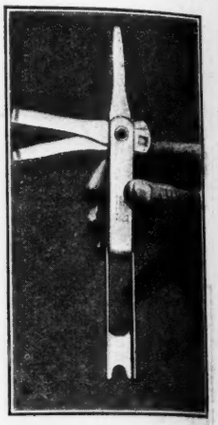
Since the body of the saw is of aluminum the tool is light in weight and easy to handle. It has a cutting capacity of two inches in hard wood and has attachments to be used for beveling or other similar purposes.

The air-cooled motor is placed directly back of the saw. This runs only while the operator holds his finger on a contact trigger switch in the handle of the tool. A guide in front of the saw enables it to cut on the line straight and clean, eliminating costly trimming operations. The tool can be run from a wall socket.

A NEW combination plier and wrench designed for many uses, can grip anything, from a cotter-pin to a nut on a three-quarter-inch bolt.

Handy Pocket Screwdriver Has Folding Blades

NEXT to a knife, a man finds himself more often in need of a screwdriver, probably, than of any other tool used for ordinary purposes.



A Michigan manufacturer recently has developed a folding screwdriver that can be carried in the pocket with one's knife. Three blades of different sizes lock open separately, giving the compact tool a wide range of usefulness. When the blades are not in use, they are locked tight in the handle.

Finds Way to Store Surplus Steam for Future Use

A SIMPLE device that enables surplus steam produced during slack hours to be stored in a reservoir until the time of peak load brings a need for it, has been devised by a Swedish engineer, Dr. Johannes Ruths.

In recognition of his valuable invention, the Swedish Academy of Engineering Science awarded the inventor a gold medal.

The steam accumulator is a large cylindrical tank with spherical ends, filled with water to 90 or 95 per cent of its capacity. Steam not needed at the moment for the engines is passed into the remaining space, where under the pressure it condenses to superheated water. Later, when more steam is needed than the boilers can supply, the water level in the tank is lowered, decreasing the pressure, and releasing the steam. Loss of temperature is prevented by a heat-insulating wall built about the tank.

New Polishing Tool Has Inflated Wheel

A PNEUMATIC wheel for grinding, buffing, and polishing, designed to speed up work along these lines, has just been put on the market. The wheel is inflated by means of a valve, just as an auto tire is inflated. The grinding surface is removable.

Sandpaper, emery, or any other abrasive surface can be attached to suit the convenience of the user. The grinding strips are held by a flange.

The operator pushes the tool along the surface of the work exactly as a plane is manipulated, the wheel being motor-driven.

The abrasive surface is attached around the circumference of the wheel, which is inflated

Automatic Machine Saves Time and Labor in Truck Loading

WHILE only one man is needed to drive a delivery truck when heavy merchandise is carried, an additional man is required to load or unload it. Double expense therefore is incurred on trucking jobs, merely for the few minutes when loading or unloading is done. For some time manufacturers have been looking for a mechanical aid, so that material could be lifted into truck bodies by the driver.

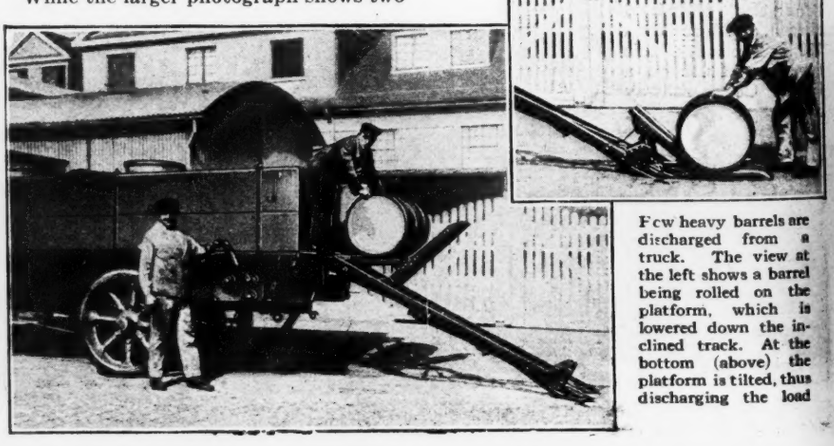
A German engineer recently invented the automatic truck loader for barrels shown in the photograph. With this, it is said, one man easily can do the work of unloading or loading.

The device consists of a V-shaped tilting platform that slides up and down an inclined track lowered from the rear of the truck. This platform, or carrier, is operated by a hand winch on the side of the truck.

When a barrel is to be unloaded, it is rolled from the floor of the truck to the platform. Lowered to the bottom of the incline, the platform encounters a stop that automatically tilts it in such a way as to discharge the barrel to the ground.

In loading, the operation is reversed, the barrel being rolled on the platform from the ground and pulled up the incline.

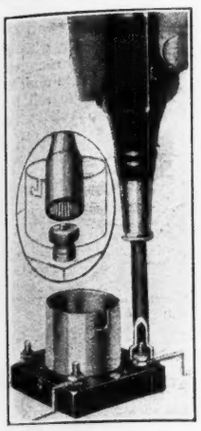
While the larger photograph shows two men at work unloading barrels from a truck, it is quite apparent that the device would enable one man to handle the heaviest loads unaided.



Few heavy barrels are discharged from a truck. The view at the left shows a barrel being rolled on the platform, which is lowered down the inclined track. At the bottom (above) the platform is tilted, thus discharging the load

New Radio Wrench Spins Round Nuts Tightly

ONE of the chief sources of trouble for the man who builds his own radio set lies in loosened connections. Small, round nuts in almost inaccessible places are particularly difficult to tighten sufficiently to insure good, permanent contacts.



The newly designed wrench shown in the illustration has sharp teeth tapered so as to grip knurled round nuts firmly, with but slight pressure. The long reach of the shank makes the tool especially useful, and the handle gives strong leverage.

The shank is tooled from one piece of steel and hardened for constant service.

Railway Ties Dated with a Brand

A BRANDING outfit to mark railway ties is a new aid in keeping railway tracks in good condition. Railway companies usually keep records of the year in which ties are laid by marking them with special nails. These are inspected at intervals, and the oldest ties replaced by new ones. The nails, however, often are knocked off and the record destroyed.

The new branding device burns into the ties the date on which they are laid. It consists of a metal plate with raised numerals indicating the month, day, and year in which the branding is done. This plate is attached to a handle and is heated by a small torch. It can be used also to brand tools and other equipment.

Gasoline is the fuel used in the small torch, which will operate from 1½ to four hours, depending upon the use to which it is put. With special attachments, the torch can be used for heating a soldering iron or for a blowtorch.

How the tool brands the date on a wooden surface

AN IMPORTANT advance in standardization has just been made in the adoption of standard screw threads by the American Engineering Standards Committee.

Numbers Cylindrical Parts Automatically

AUTOMATIC numbering of cylindrical metal parts has been made available for machine-shops by the recent invention of a machine that also will stamp names and trade marks on the work at the same time that the numbering operation is performed.

The parts to be numbered are carried on a special holding fixture on the table to which the device is attached, and are rotated automatically into the correct position.

For ordinary changing of the numbers a hand lever is depressed to give the next highest number. The lever strikes a fixed point on the holding fixture, and automatically advances the numbering dies. This arrangement makes the device adaptable for serial numbering.

Simple Rack Keeps Paint Brushes Pliable

IT IS a well known fact that paint brushes will last twice as long if they are properly cared for. To assist the professional painter, as well as the home worker, in keeping brushes in good working condition, the simple rack pictured at the left recently has been invented. It accommodates brushes of almost any size, suspending them in water or whatever other liquid is used to keep the brushes soft and pliable.

The rack rests on the container, no matter what its size or shape, and forms a series of slots in which the brush handles are held.

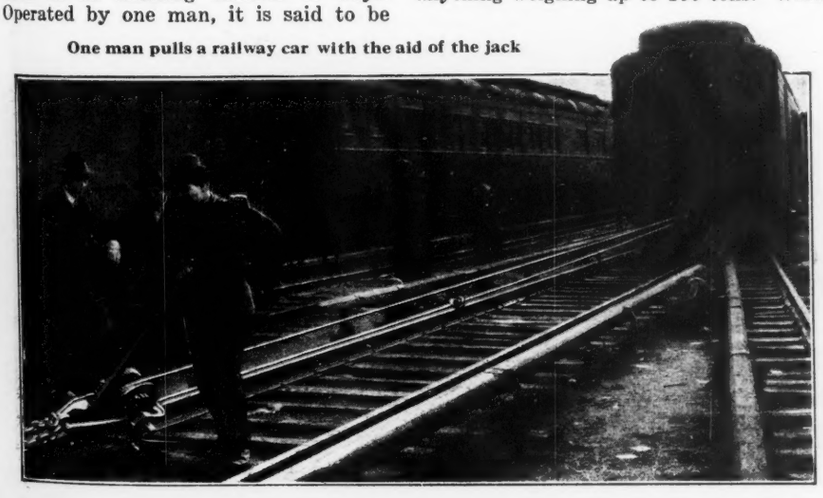
With Powerful New Jack One Man Pulls a Steel Railway Car

FOR pulling and hoisting work, a powerful little machine called a "pulling-jack," recently invented, can be used in an amazing number of ways. Operated by one man, it is said to be proving a great labor-saver, especially in house-wrecking and on railways.

It is declared to be capable of moving anything weighing up to 100 tons. With the jack one man can pull down a whole brick pier, a wall, or chimney, ordinarily the work of many men. In the photograph the jack is being used to pull a derailed steel railway car back on the rails. For stump-pulling and moving heavy machinery it is said by the manufacturers to be very efficient.

The machine combines the principles of the lifting jack and winch. A pawl-and-ratchet mechanism is used to wind a cable on a drum. The jack can be operated at six different speeds.

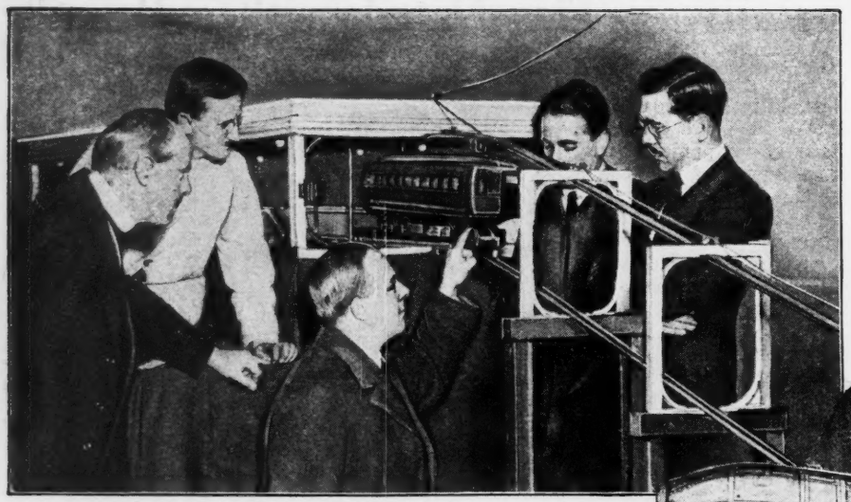
One man pulls a railway car with the aid of the jack



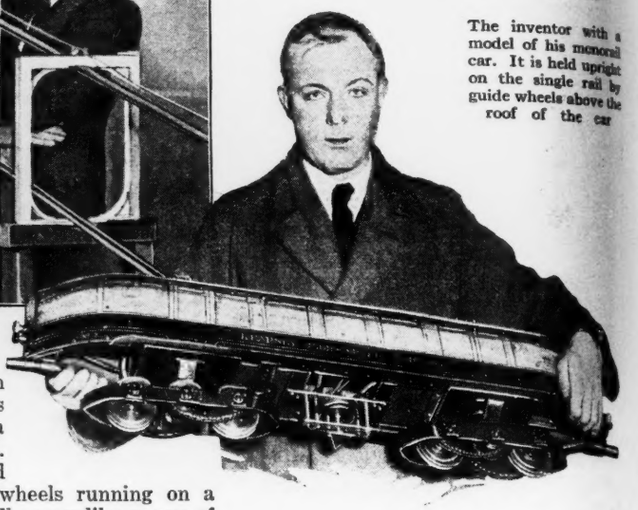
Cleans the High Lights in Shops and Offices

TO FACILITATE the cleaning of electric-light fixtures and reflectors located far from the floor, a new brush mechanism attached to a long handle recently has been perfected. A lever at the side of the handle holds the brushes against the surface to be cleaned, and a hand crank revolves the brushes.

Monorail Subway Proposed in England



Demonstrating a model of the proposed high speed monorail subway. Emerging from the station the car dips down into a deep tube



The inventor with a model of his monorail car. It is held upright on the single rail by guide wheels above the roof of the car

A HIGH-SPEED underground railway system in which cars running on a single rail could travel at the rate of 60 miles an hour, is the latest suggestion offered in England to solve the transit problems of large cities. A demonstration was given recently by means of working models by the inventor.

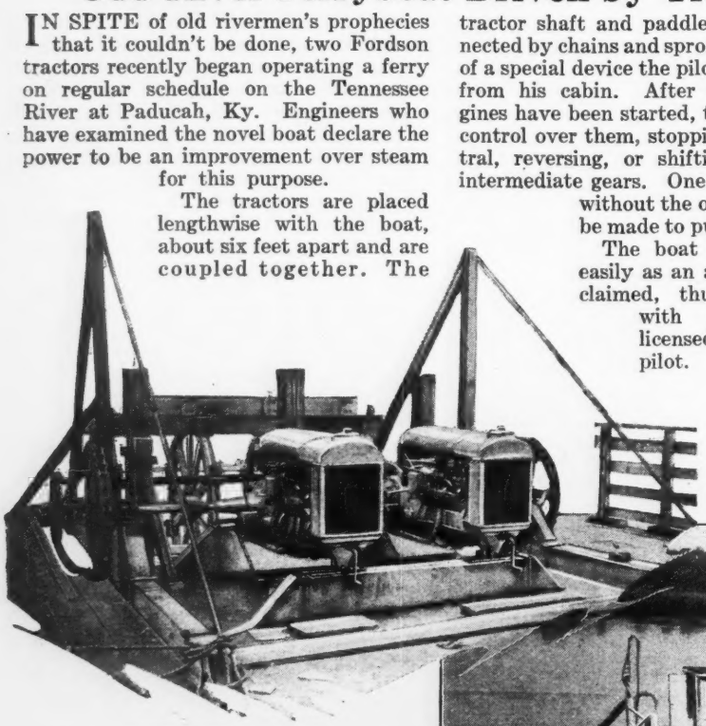
The proposed system would consist of stations just below the surface, connected by deep tubes in which the cars would run on a single ground rail. They would be held upright by guide wheels running on a guide rail above. The wavelike course of the railway, the inventor believes, would serve to quicken the speed of the trains on departure and to retard them at the approaches to a station. For maximum speed, as well as comfort, the inventor has designed special streamlined cars.

Odd River Ferryboat Driven by Tractors

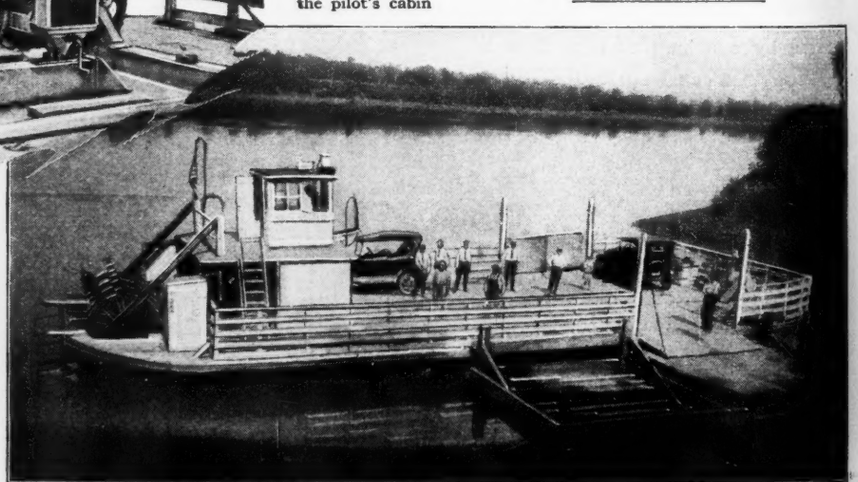
IN SPITE of old rivermen's prophecies that it couldn't be done, two Fordson tractors recently began operating a ferry on regular schedule on the Tennessee River at Paducah, Ky. Engineers who have examined the novel boat declare the power to be an improvement over steam for this purpose.

The tractors are placed lengthwise with the boat, about six feet apart and are coupled together. The tractor shaft and paddle wheel are connected by chains and sprockets. By means of a special device the pilot can shift gears from his cabin. After the tractor engines have been started, the pilot has full control over them, stopping them in neutral, reversing, or shifting to low and intermediate gears. One tractor can run without the other or both can be made to pull together.

The boat can be run as easily as an automobile, it is claimed, thus doing away with the need of licensed engineer and pilot.



How the two tractors are geared to the stern paddle wheel. They are controlled from the pilot's cabin



The novel tractor-driven ferryboat docked at Paducah, Ky., on the Tennessee River

Novel Test Shows Strength of Bridge Railing

AFTER an accident in which part of the concrete balustrade of a bridge at Springfield, Mass., was knocked down, engineers made unique tests to determine its exact strength. They used levers consisting of wooden planks inclined at an angle, butted against the base of the railing. Ropes tied to the planks were attached to the top of the railing by means of hooks.

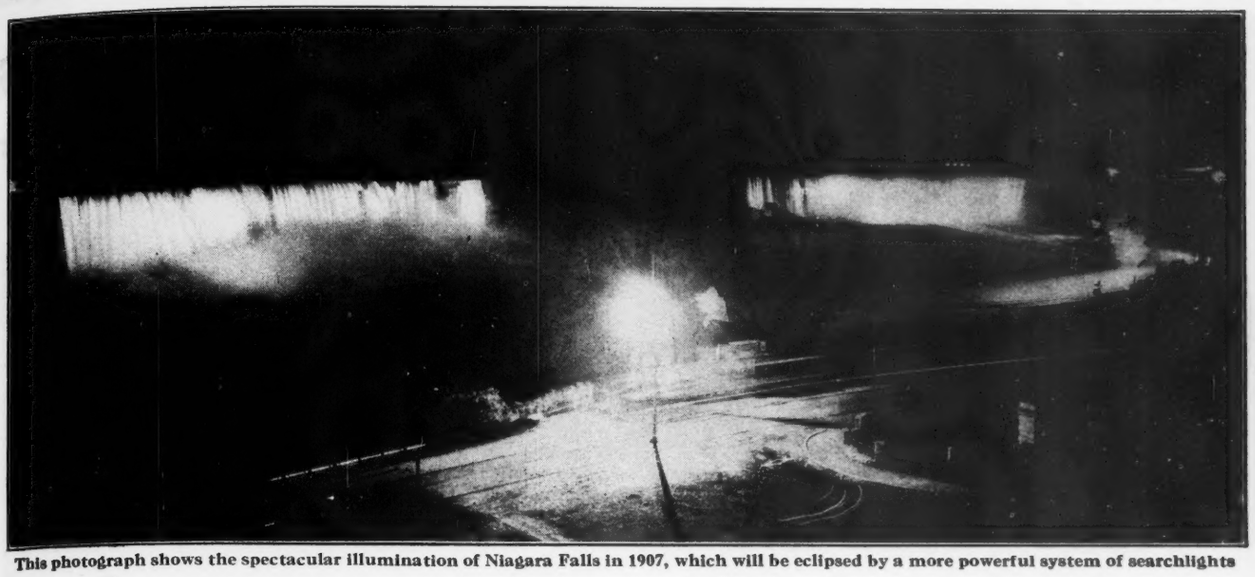
Sand was poured into weight boxes on the ends of the planks. The amount in these boxes when the railing fell determined the weight necessary to overturn the railing. Although the railing fell inward instead of into the river in the tests, the results were taken as holding for either direction.

The tests served to establish standards of strength for future bridge construction.

World's Greatest Tunnel

THE greatest tunnel in the world soon will be built under the Mersey River in England to link the city of Liverpool with Birkenhead and adjacent towns on the south bank of the river. It will have an internal diameter of 44 feet, greater than the Hudson River tunnel now under construction.

The tube will contain two decks, one for automobiles, the other for streetcars.



This photograph shows the spectacular illumination of Niagara Falls in 1907, which will be eclipsed by a more powerful system of searchlights

Niagara to Be Illuminated

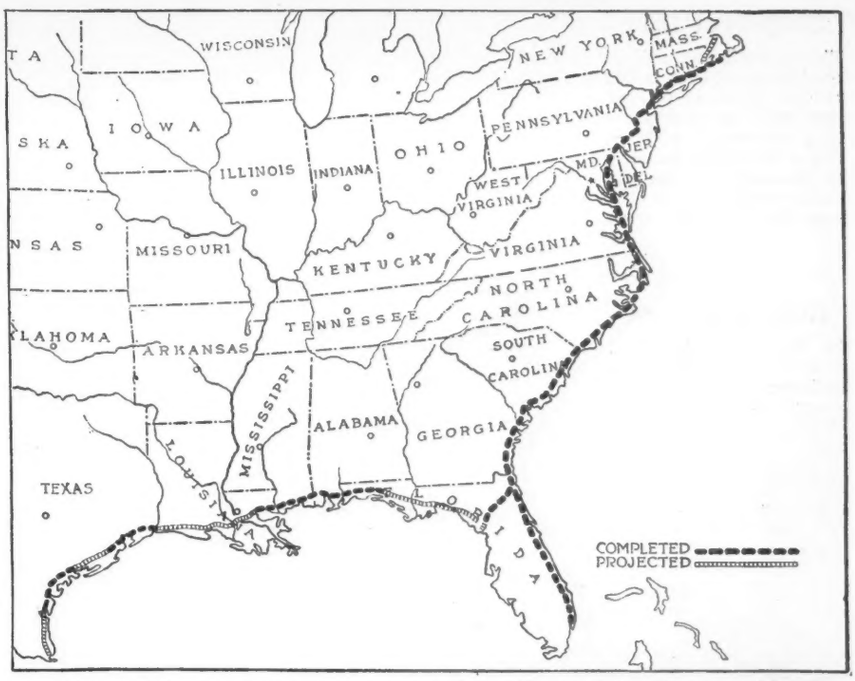
THIS spectacularly beautiful effect, the illumination of Niagara Falls at night with searchlights, will be permanent after May 24. Twenty-four powerful searchlights, casting 1 1/3 billion candlepower, will be dedicated on that date, which is Queen Victoria's birthday.

Eighteen years ago the falls were lighted for 30 days, attracting thousands of spectators. The above photograph was taken at that time. In the new lighting of the falls, more powerful lights will be used, color screens and light drills sending beams that will be seen for 75 miles around.

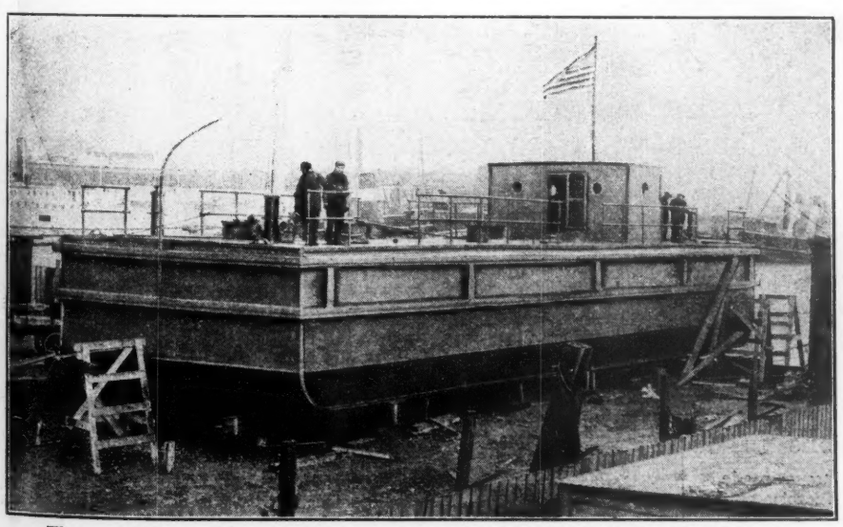
A Ship without a Rivet

AN OIL-TANKER in one piece, without a rivet in its hull plates or a bolt in its steel frame, the first one ever built in the United States by the electric welding method, was launched recently in Providence, R. I.

Terrific heat generated by electricity fused together the sheets of steel and heavy angle iron in the tanker's frame.



Projected chain of natural waterways along the eastern coast from Boston to Mexico



The remarkable one-piece welded boat just before launching at Providence, R. I.

U. S. Plans to Link Chain of Coastal Waterways

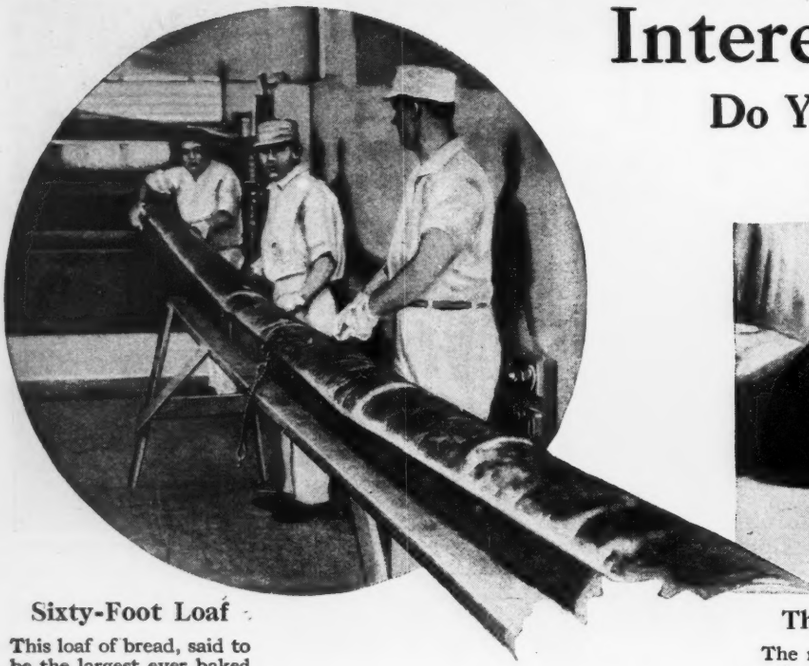
BY LINKING a long chain of natural waterways with canals a continuous channel eventually will be available along the entire eastern coast of the United States, from Boston to the Mexican boundary on the Gulf of Mexico. By far the greater part of this route is now open for boats of limited draft. The entire route has been surveyed by U. S. Government engineers.

It is possible today to make the entire trip from Massachusetts to Florida with small craft without once going to sea.

The great system of canals that extends from New England to Florida is known collectively as the Atlantic Intercoastal Waterway. When the work now in progress is complete, it will afford a continuous channel 12 feet in depth as far south as Beaufort, N. C.

Interesting Giants

Do You Know of Any Better

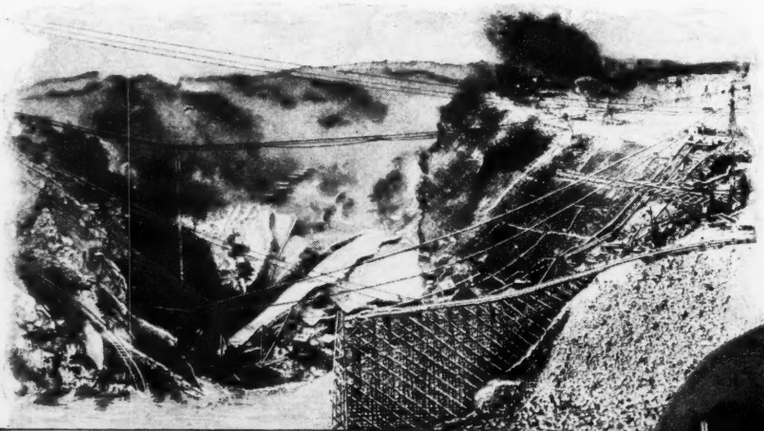


Sixty-Foot Loaf

This loaf of bread, said to be the largest ever baked in one piece, is 60 feet long and contains more than 400 pounds of flour. It was turned out recently in Minneapolis. Bakers here are seen removing the huge loaf from the oven

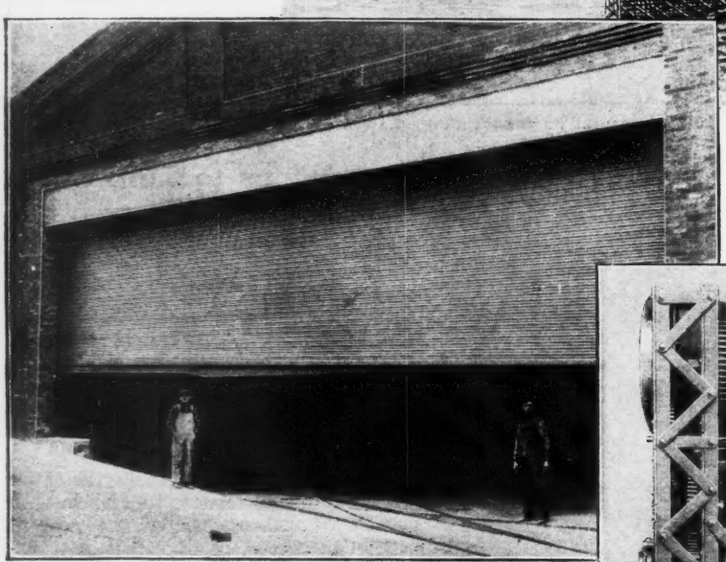
The World's Smallest Fountain Pen

The midget fountain pen will hold a drop of ink and write 300 words, while the large one will hold 120 drops and write 36,000 words. They are shown side by side



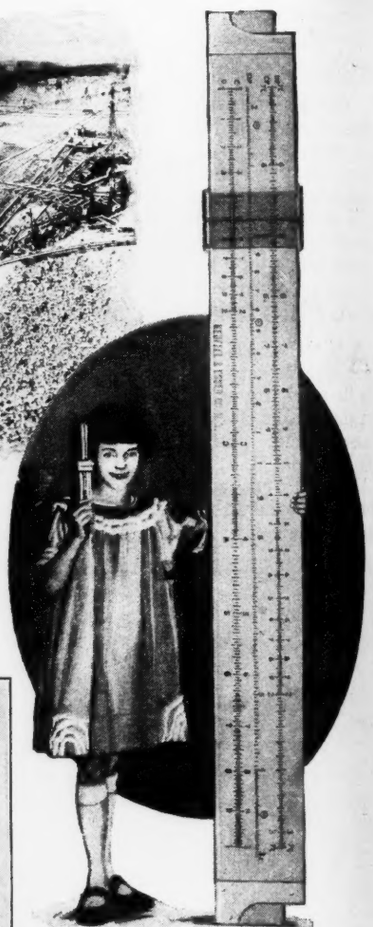
Huge New Dam

In the Kentucky hills near the town of Burgin, engineers are constructing what is said to be the world's largest rock-filled dam. When completed it is expected to develop 36,000 horsepower, 13,000 more than the great Roosevelt Dam in Arizona



Rolling Door Weighs Two Tons

This two-ton rolling steel door, said to be the largest made, was installed recently in a Brooklyn, N. Y., factory at a switching entrance 45 feet wide and 17 feet high. It is operated by an electric motor, which is shown at right

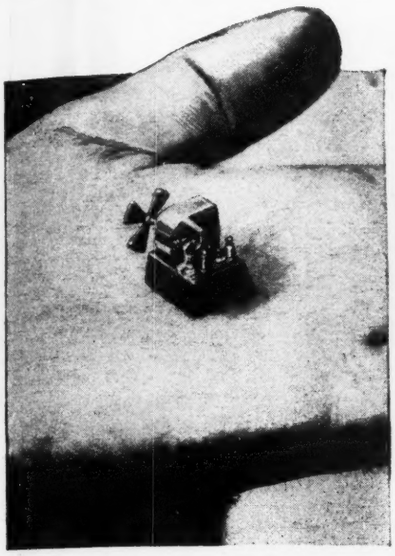


Twenty-Foot Rule

The makers of this enormous slide rule say it is the world's largest. It is 20 feet long when extended, and 10 feet long when closed. Compare it with the ordinary foot-rule that is held in the child's right hand

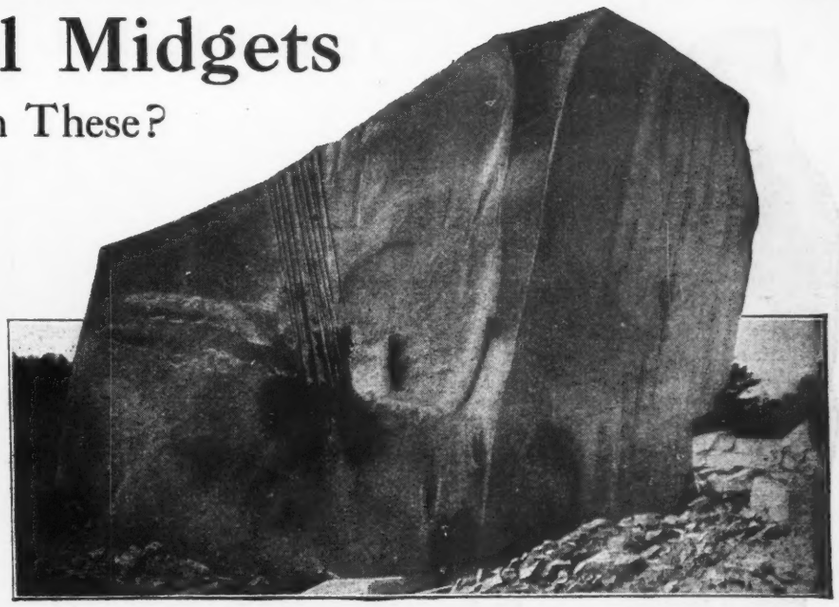
and Unusual Midgets

Claims to Records than These?



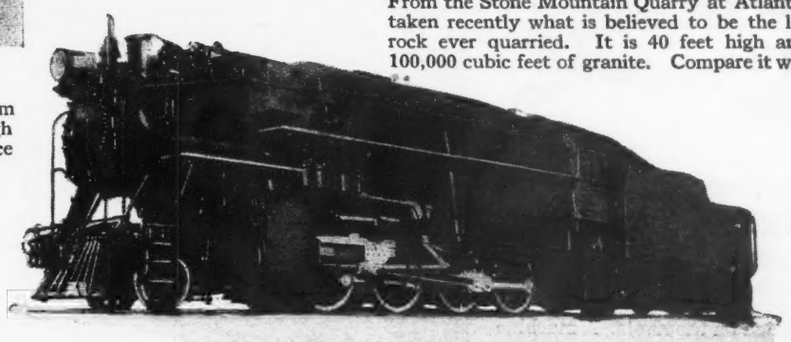
Inch-High Electric Motor

The tiniest motor, made by H. McBroom of Houston, Tex., is less than an inch high and weighs only a quarter of an ounce



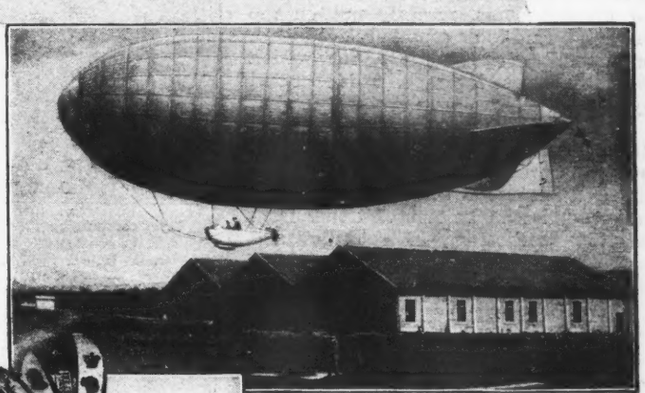
The Largest Rock Ever Quarried

From the Stone Mountain Quarry at Atlanta, Ga., was taken recently what is believed to be the largest solid rock ever quarried. It is 40 feet high and contains 100,000 cubic feet of granite. Compare it with the man



Railway Giant

Two hundred and three tons of steel make up this giant locomotive recently designed by a Delaware & Hudson Railway engineer. It is said to develop one-third more power on one-third less fuel than any previous locomotive

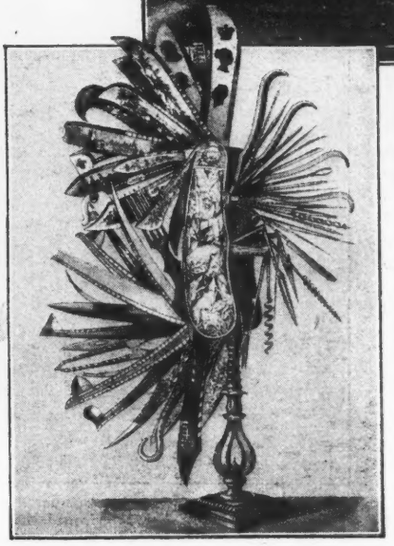


Midget among Airships

The world's smallest semi-rigid dirigible, the MR, was completed in Rome a few weeks ago from designs by Lieut.-Col. Umberto Nobile. This little airship is only 105 feet long, as compared with the 663-foot length of the dirigible *Los Angeles*. It is designed to develop a speed of about 40 miles an hour

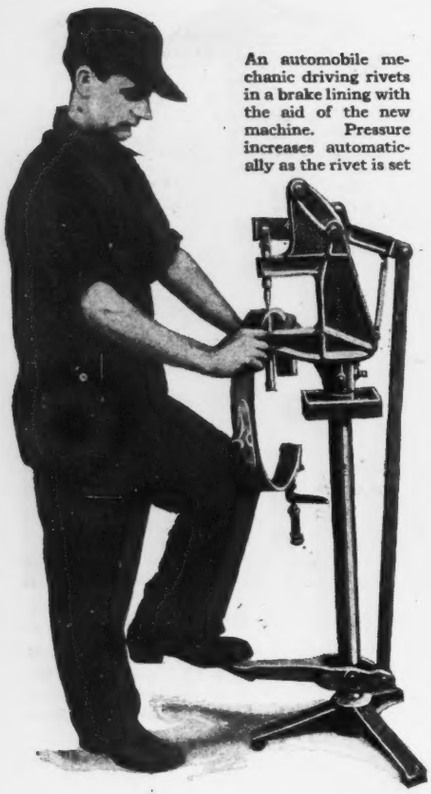
A Book with 4000 Pages

Containing 4000 pages, this Chamber of Commerce registry book is said to be the bulkiest volume in the world. It weighs 340 pounds



A Knife with 75 Blades

Some of the smallest blades ever made are contained in a marvelously carved knife produced by William Bamforth, member of a cutlery firm in Sheffield, England. The knife contains 75 blades, many of them ornamented with designs that are considered among the most perfect ever worked in steel



An automobile mechanic driving rivets in a brake lining with the aid of the new machine. Pressure increases automatically as the rivet is set

New Riveting Machine Aids in Relining Brakes

IN RELINING brakes, rivets must be made absolutely tight, else the brake bands will soon break loose on account of chafing action on the rivets. A machine for driving rivets, recently put on the market, is said to do especially good work on account of its toggle action, which gives it increased leverage. It is operated by a pedal.

At the beginning of the riveting operation comparatively light pressure is exerted, the pressure increasing automatically as the rivet is set. Small or large brake bands can be riveted either from the top or bottom. Eight dies and punches are furnished with the machine.

Bumper and Emergency Winch Combined

OFF the main highways, on bad country roads, the automobile driver often has to depend entirely upon his own efforts to get himself out of trouble. When stuck in mud or sand, the combination bumper and winch shown in the photograph at the right would prove a welcome aid. Attaching the line to a near-by tree or telephone pole, a man without other assistance could pull his car out on to firmer ground.

The winch is so geared that 100 pounds of power on the hand lever by which it is operated produces 5000 pounds on the line. Small springs prevent rattling in the bumper.

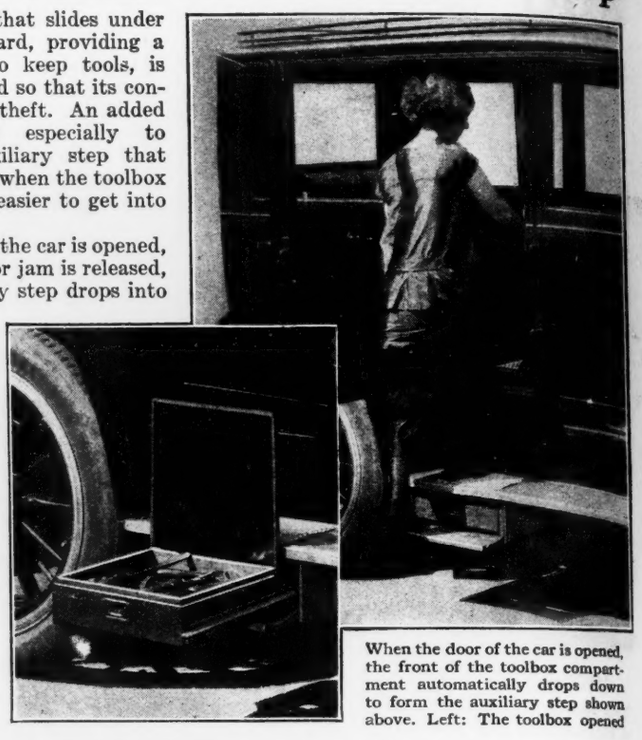
BY HEATING heavy and vegetable oils by electricity, a Russian inventor, M. Makhonine, recently perfected for the French army what he claims to be a cheap and efficient motor fuel.

Toolbox Forms a Convenient Step

A METAL box that slides under the runningboard, providing a convenient place to keep tools, is automatically locked so that its contents are safe from theft. An added feature, appealing especially to women, is an auxiliary step that comes into position when the toolbox is open, making it easier to get into the car.

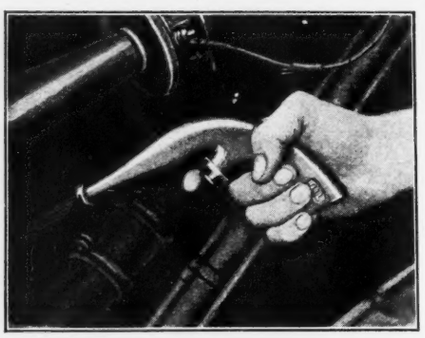
When the door of the car is opened, a plunger in the door jam is released, so that the auxiliary step drops into place, at the same time making the toolbox accessible.

THE world spent $3,360,000,000 for new motor vehicles in 1924, a survey by the U.S. Department of Commerce shows. On January 1 of this year there were in operation in all countries 18,615,000 passenger cars, 2,892,000 trucks and 1,262,000 motorcycles.



When the door of the car is opened, the front of the toolbox compartment automatically drops down to form the auxiliary step shown above. Left: The toolbox opened

Compressed-Air Pistol Cleans Parts Quickly

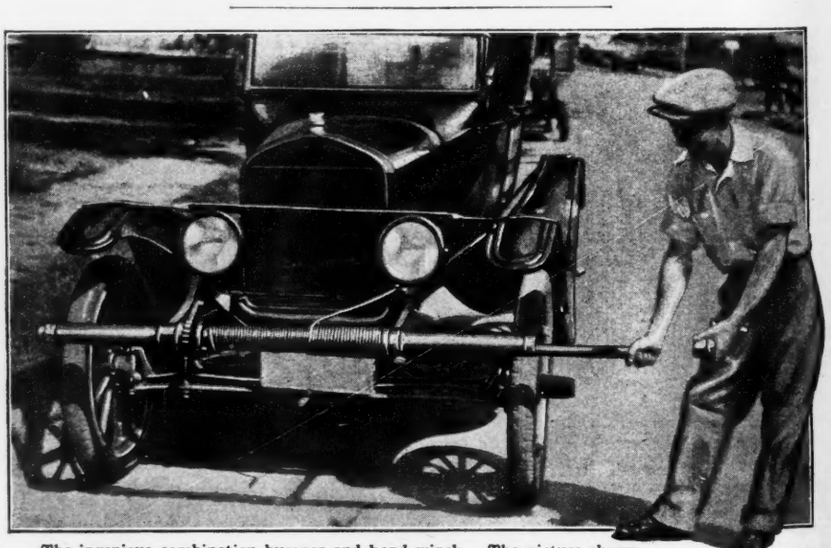


The cleaning spray of gasoline or kerosene is controlled by the pistol trigger, which is operated by compressed air

OPERATED by means of compressed air, this spraying gun is designed particularly for cleaning automobile engines, transmissions and gears. Either gasoline or kerosene may be used. The spray is controlled by a trigger, and the gun is gripped and held like a pistol.

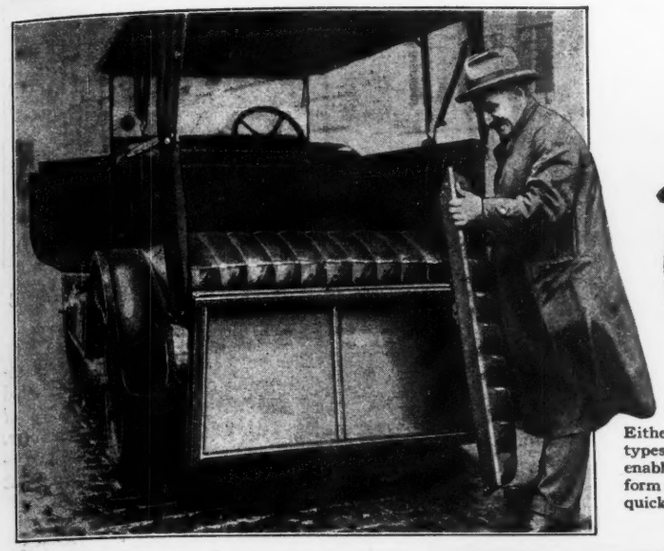
The device may be used, also, for applying wood preservatives, insecticides, creosote, thin paint, or whitewash.

THE streets of Paris, France, now are swarming with miniature one-passenger taxis, compact and light, and exceedingly economical in tires, gasoline consumption, and cost of manufacture. They have a wheel track of only 46 inches.



The ingenious combination bumper and hand winch. The picture shows a driver pulling out the iron lever by which the powerful winch is operated. The line can be attached to a near-by tree or a telephone pole

Cars for Business or Pleasure



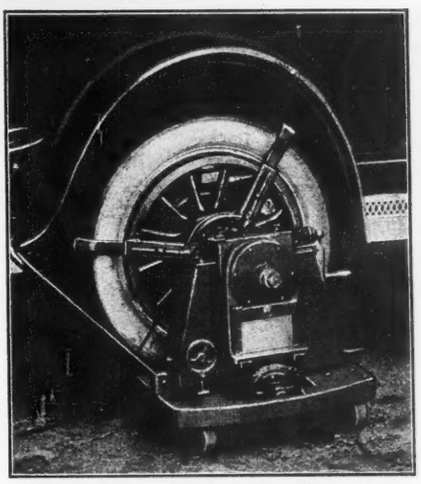
Either one of these two types of convertible bodies enables the owner to transform his pleasure car quickly into a small truck

This Auto Can Be Turned into a Delivery Truck

A QUICK change from a comfortable and roomy pleasure car to a small delivery truck has been made possible by a newly devised automobile body with convertible seats.

When it is to be used for pleasure, the car is provided with upholstered rear seats. When it is to be converted into a delivery truck, these seats are taken down and reversed to form a smooth, even floor. The rear of the body is on hinges and swings downward to provide access to the truck from the rear.

THE state of Massachusetts recently began consideration of a plan to utilize the roadbeds of abandoned railways as possible highways for motor-truck transportation routes.



Driven by an electric motor, this testing machine turns the wheel against the brake,

Convertible Body Useful for the Farmer

ANOTHER new type of convertible body for Ford cars is especially designed for farmers and merchants who use their machines for both pleasure and business. This body is so designed that the rear seats fold forward into the floor and out of the way. A tail gate can be lowered from the rear.

When the tail gate is closed, there is nothing to distinguish the machine from other pleasure cars of the same make.

The manufacturers claim that it can be converted from pleasure to business car in less than a minute.

Auto Brakes Now Tested by Machinery

TOO often the adjustment of automobile brakes has been done by approximation and guessing. By means of an ingenious dynamic brake tester recently invented, one can tell exactly how many pounds of pressure there is on a brake drum while the wheel is in motion, and make adjustments accurately.

Only one man is required to make the test with this machine. After jacking the car off the floor, he sets the brake pedal with a special depresser that holds the foot or service brake under a constant pressure. The brake tester, driven by a motor, is then clamped firmly to the automobile wheel.

An electric motor turns the wheel against resistance of the brake, and an indicator on the machine records the number of pounds pressure at all points on the brake drum. Adjustments can be made while the brake tester is on the wheel.

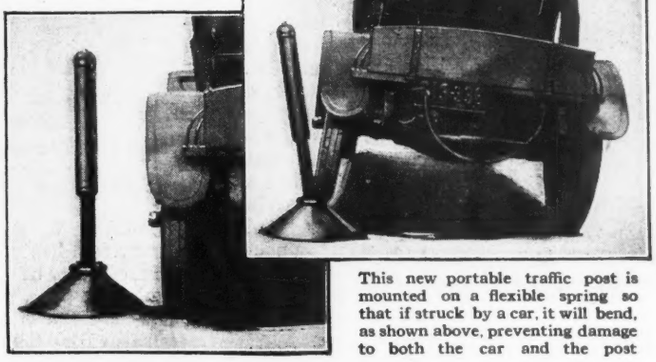
In case of four-wheel brakes, the front wheels usually are given two-thirds of the pressure applied to the rear wheels.

Flexible Traffic Post Takes Hard Knocks

SCIENCE and man's inventive genius are continually trying to care for the careless motorist. One of the resultant products is a portable flexible "iron man" as a traffic guide for street crossings. The invention is designed especially for suburban and rural districts where stationary concrete or metal traffic posts very often are a menace, especially at night-time.

When a car strikes this signal post, no damage is done, for the upright shaft is mounted on a heavy but flexible spring. This allows the signal to bend down out of the way so that the car may pass over it harmlessly. The upper half is made of tube steel and is half an inch larger than the supporting spring.

When a careless motorist rubs or knocks against the signal, the tube striking against the spring rings so that it may be heard two blocks away. Red lights may be attached to the post. Snow, ice, and inclement weather are said not to affect the operation of the new signal device.



This new portable traffic post is mounted on a flexible spring so that if struck by a car, it will bend, as shown above, preventing damage to both the car and the post

Plan Revolving Garage

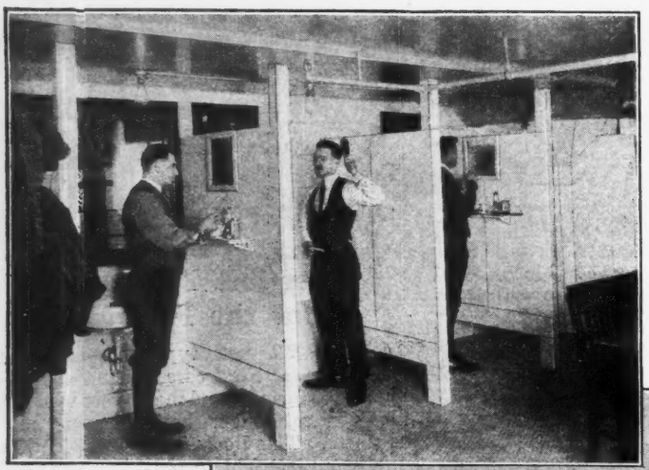
A POSSIBLE solution of the shortage of parking and garage accommodations is offered in a revolving garage to be erected soon in the West End of London, England.

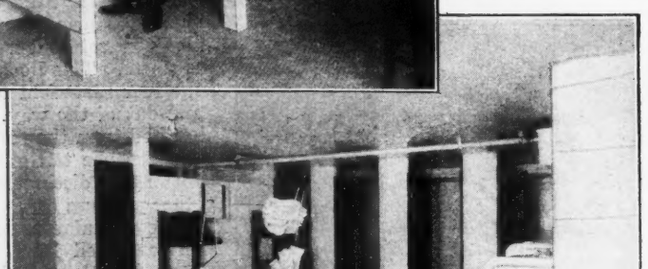
The floors of the garage will be arranged as concentric rings, each of which will be divided into a number of one-car compartments. The floor will be revolved so that any compartment can be brought into line with the main entrance.

Dressing-Rooms for Taxi Drivers

KEEPING clean and well groomed is a business matter. This is the belief of a Chicago taxicab company that recently installed dressing-rooms for its drivers in several garages. These rooms are equipped with the most modern conveniences for bathing, shaving, grooming, and even for polishing shoes.

No one appears more constantly before the public than a taxicab driver, and upon his appearance, the company believes, depends largely the public's attitude toward his employers. With a good appearance comes a bearing of self respect.





It Pays Them to Look Fit

Each taxi driver is provided with an individual dressing room, fitted with porcelain washbasin, shaving mirror, and toilet accessories, as shown above. Here he keeps himself well groomed for the day's job. In addition, the most modern bath and toilet facilities are at his service

A FRENCH inventor, De Grammont de Guiche, has perfected a method that enables an airplane pilot to tell by sound his exact flying speed.

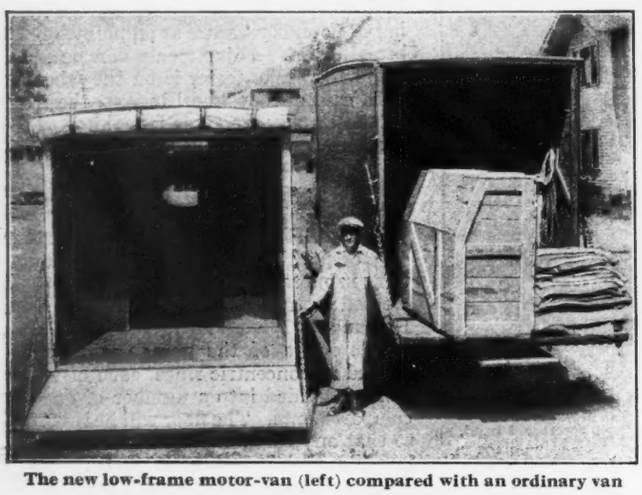
Heavy Moving Simplified by Low-Slung Van

THE heavy job of lifting large packing cases and articles of furniture in loading or unloading a motor-van has been made much easier and simpler, it is claimed, by the recent development of a new type of truck with extremely low chassis and body.

The floor of the moving-truck is hardly above the knees of the average sized man, thus greatly reducing the lifting distance for the furniture remover or the expressman.

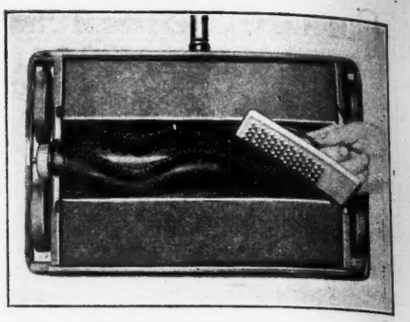
The low center of gravity also is said to assure greater safety in turning corners with a heavy load, and better riding qualities over rough roads.

The new design, known as the low drop-frame chassis type, is the invention of a California truck manufacturer. A striking comparison with the ordinary type of motor-van is shown in the accompanying illustration.



The new low-frame motor-van (left) compared with an ordinary van

BY CAUSING successive waves of sound to interfere with each other's transmission, Dr. G. W. Stewart, a professor of physics at the University of Iowa, has perfected a device that he believes in time may be used to eliminate undesirable noises and to adjust sounds to suit the taste and the nerves of any individual.



Simple Wire Brush Keeps Carpet-Sweepers Clean

STRONG bent wires in this newly invented brush quickly remove tangled hair and thread from the brushes of carpet-sweepers or from vacuum cleaners. Thus a common annoyance to the housewife has been removed by a simple but effective invention.

Electrical Blower Cleans Dust from Machinery

OPERATING either as a suction cleaner or blower, an ingenious new electrical aid for the mechanic removes coal dust, dirt, and other accumulations from machinery. A hose attachment enables the operator to get at all parts of a large machine or switchboard and eliminate all dust.

The cleaner can be attached to any light socket. In the photograph the device is shown being used as a blower. When used as a suction cleaner, a dust bag is attached. The apparatus can be slung over the shoulder of the operator with a strap, leaving both his hands free for work.

When operated as a blower, the air leaves the nozzle at a velocity of 200 feet a second—nearly 140 miles an hour.

Cleaning machinery with electric blower

Sugar Made from Weeds

LEVULOSE, a valuable sugar that heretofore has cost from $30 to $110 a pound, can now be made cheaply enough for table use by a process perfected by the U. S. Bureau of Standards. It is extracted from dahlias and from Jerusalem artichoke, a common weed.

This New Floor-Waxer Has Removable Pads

BOTH the waxing and polishing pads of a new floor-waxer, which weighs only a few pounds, are removable for washing.

After the wax is spread on the floor with the outside pad, it is unbuttoned and the floor polished with the dry pad underneath.

New Belt-Lacing Machine Saves Time and Labor

FOR lacing broken belts quickly, leaving smooth and strong joints, a compact machine has been designed to save the time required by hand work. Belts not over three-eighths inch thick may be laced in a few minutes without removal from the shaft. The tool is designed not only for machine shops and factories in mending heavy belts, but for garages in repairing fan belts. With this tool a garage need keep on hand only a few rolls of belting in popular widths to make up fan belts as required.

No two hook points enter the belt directly opposite each other, so that no belt fibers are broken. The machine embeds the hooks even with the belting surface.

Mending a heavy machine belt

Detects Artificial Pearls

A SIMPLE new method of distinguishing the Japanese artificial pearl from natural pearls has been discovered by Prof. Daniel Bertholet, a French scientist. He plunges the pearl into cedar oil brilliantly illuminated with converging lights and examines it through a submersible lens.

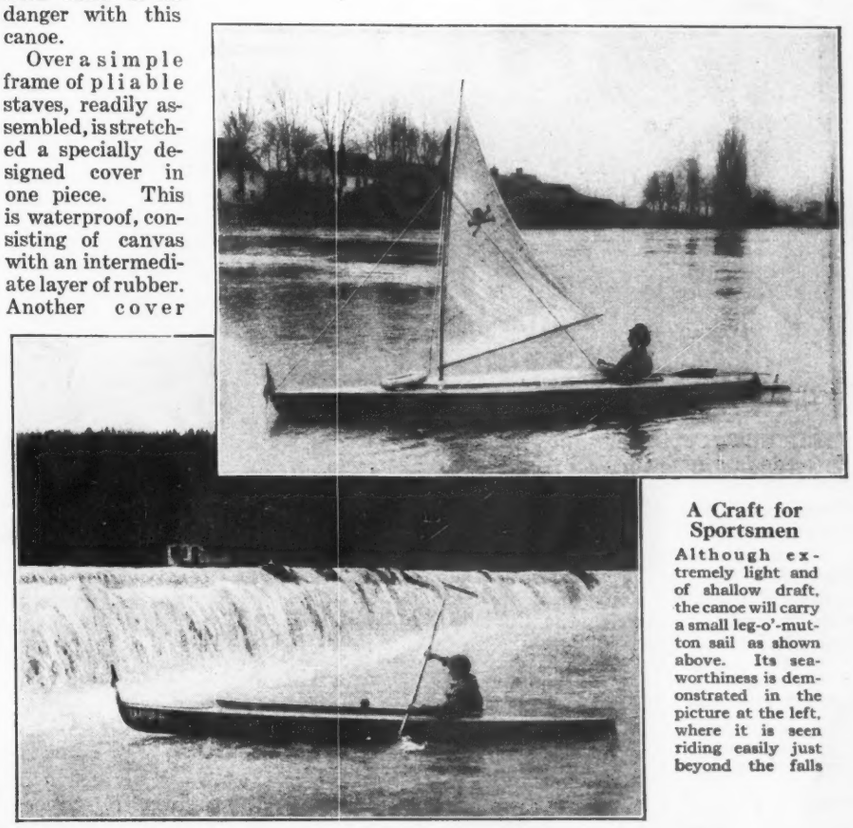
Canoe-Sailboat Is Collapsible

A NEW design of collapsible canoe that can be converted into a sailboat, is of particular interest to hunters and fishermen. Because of its extreme lightness it can be used on all waters with safety, it is claimed, even in shallow streams.

The thrilling sport of shooting rapids loses much of its danger with this canoe.

Over a simple frame of pliable staves, readily assembled, is stretched a specially designed cover in one piece. This is waterproof, consisting of canvas with an intermediate layer of rubber. Another cover protects the cockpit from rain and splashes of water.

Rigging can be added to the canoe without damage to the structure. The canoe will carry three persons comfortably, it is said, while allowing plenty of room in which to stow away luggage. The frame can be packed in one or two bags.



A Craft for Sportsmen

Although extremely light and of shallow draft, the canoe will carry a small leg-o'-mutton sail as shown above. Its seaworthiness is demonstrated in the picture at the left, where it is seen riding easily just beyond the falls

Hand Levers Drive Odd Oarless Lifeboat

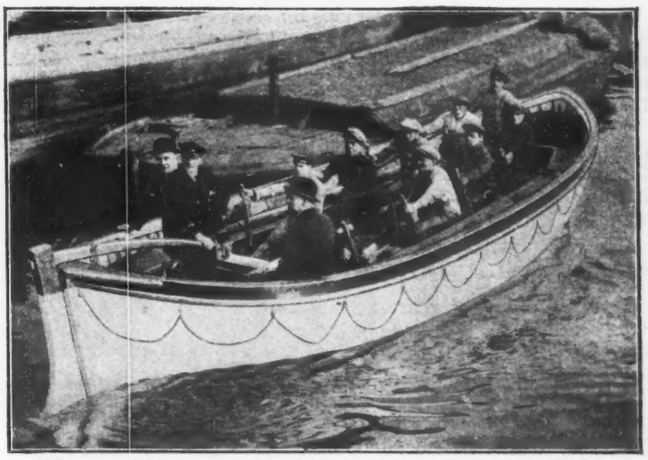
ROWING a boat without oars is the surprising achievement made possible by a British inventor, who recently designed an unusual new type of lifeboat propelled by hand levers. The purpose of the invention was the creation of a craft that could be sent away from the side of a disabled ship without the delay of adjusting oars in their locks.

In place of oars, levers are provided in front of each seat in the boat. There are eight levers in all—four on each side of the craft. They are geared to a propeller shaft so that as the oarsmen pull them back and forth they drive a screw at the stern, sending the boat through the water.

Since, contrary to the old way of rowing, no especial skill is required to operate the levers, the boat requires only one trained seaman to handle the tiller.

The invention was demonstrated recently at the King George Dock, London.

BECAUSE of temperature expansion and contraction, the Washington Monument is about 5½ inches higher in summer than in winter.



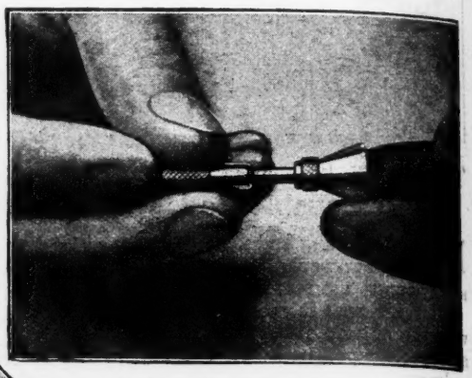
Demonstrating the new lever-propelled lifeboat at King George Dock, London. Geared to the propeller shaft, the levers drive the screw

Ingenious New Devices

Fourteen Handy Products from

Self-Soaping Brush

A TWO months' supply of shaving cream is contained in the handle of a new type of shaving brush (below) designed especially for the traveling man. Pressing the handle forces just enough cream for a shave into the bristles of the brush.



A Pocket Cigar Piercer

OCCASIONALLY the smoker encounters a cigar that requires considerable coaxing with a pin or other sharp instrument before it will draw satisfactorily. It is because even the best cigars are not always perfect in this respect that the pocket cigar piercer pictured above has been invented recently.

The device consists of a thimble-shaped metal socket into which the end of the cigar is held. Entering the socket is a small drill that is twisted with the fingers.

Stencil Makes Bow Lips

PERFECT Cupid's-bow lips can be made in a few seconds, even by persons who are inexpert at make-up, it is claimed, with the aid of a newly devised beauty stencil.

The flexible stencil is held firmly over the mouth so that the opening fits the outline of the lips. Rouge or a lipstick then is applied, producing the Cupid's-bow effect.

Wooden Fins for Swimmers

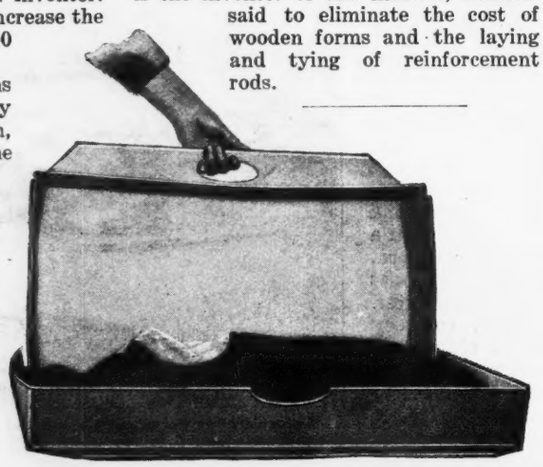
BATHING shoes fitted with hinged wooden fins are the latest aids for the swimmer devised by a Dutch inventor. He claims that the shoes will increase the speed of a swimmer at least 10 times.

When pulled forward, the fins close, and when forced out by the stroke of the feet, they open, pushing powerfully against the water.

Floor Slabs of Concrete

A SAVING of 30 per cent in building costs is said to be made possible by a new method of reinforced concrete construction. In this process small factory-made slabs of reinforced concrete are used instead of the present method of pouring concrete in large slabs. Floors, walls, and partitions made of the small units, the inventor claims, will stand strains that reinforced concrete in one piece will not, and air spaces are provided in which wires and pipes may be laid. These further serve to make walls or partitions soundproof.

A. G. Tabatchnik, a Russian architect, is the inventor of this method, which is said to eliminate the cost of wooden forms and the laying and tying of reinforcement rods.



Handy Suit Box

A NEW type of pasteboard suit box is made in one piece, with a handle for the lid cut in the board. The box opens like a suitcase and requires no twine to hold it together. Each end of the box is reinforced by a double piece.

All-Sport Hand Racket

FOR any of the many kinds of ball games that boys and girls play in the street or against brick walls, this light hand racket recently has been perfected. The frame and strings are made of gut, with a thin wood backing. The hand fits into an adjustable back strap.

for Pleasure and Comfort

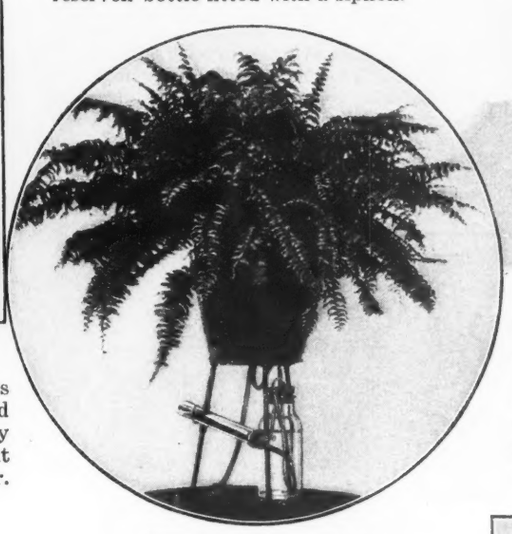
the Workshops of Inventors

Reflector Serves as Stove

A JOINT in the stem of this ingenious gas reflector permits it to be turned into a simple burner upon which one may cook the morning coffee. When upright the device serves as an ordinary heater.

Ferns Water Themselves

FERNS water themselves if provided with the apparatus recently devised. The soil absorbs water from a porous porcelain cone that drains water from a reservoir bottle fitted with a siphon.



Adjustable Safety Razor

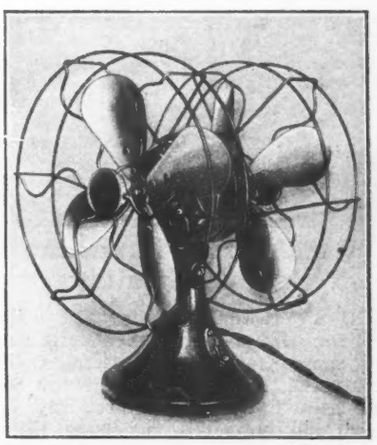
THE latest type of safety razor may be adjusted to any desired angle. The shaver may use it in the regular safety style with the blade at right angles to the handle, or at another angle, giving a diagonal stroke.

A Squeakless Porch Swing

TO ELIMINATE squeaks in porch swings, Joseph E. Morse, of Huntington, Ind., has invented a hanger of ball-and-socket joints suspending the hooks to which the chains are attached.

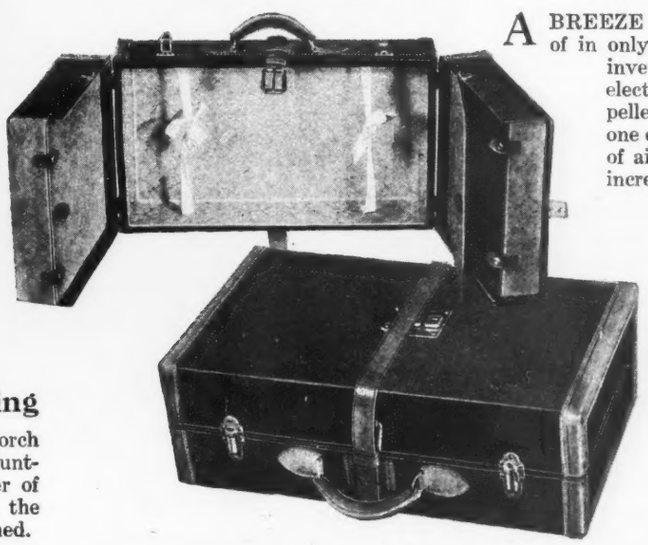
New Full-Length Mirror

THIS portable floor mirror invented by a Frenchman, shows the hem of a skirt, the grace of a neck line, or the entire gown, thus serving the purpose of a full-length mirror. It is easily adjusted to position.



Two-in-One Fans

A BREEZE in all directions instead of in only one, was the aim of the inventor of this two-in-one electric fan. It has two propellers on the same spindle, one on each side. The quantity of air distributed is said to be increased.



New Suitcase

POPULARITY of the wardrobe trunk led to the manufacture of a new suitcase that has a compartment for hats as well as for shoes and soiled clothing. In one half is ample space for suits or dresses, while the other half is divided into the two sections.

Home Chlorine Treatment for Colds

How the new chlorine inhaler is used for the treatment of colds at home. A special chlorine compound is used

FOR treating colds at home with chlorine gas, a gas-generating inhaler recently has been devised. This is used with a special compound containing chlorine, which is given off when the substance is heated.

The strength of the gas is said to be easily regulated by the patient and a single treatment to cost about a cent and a half.

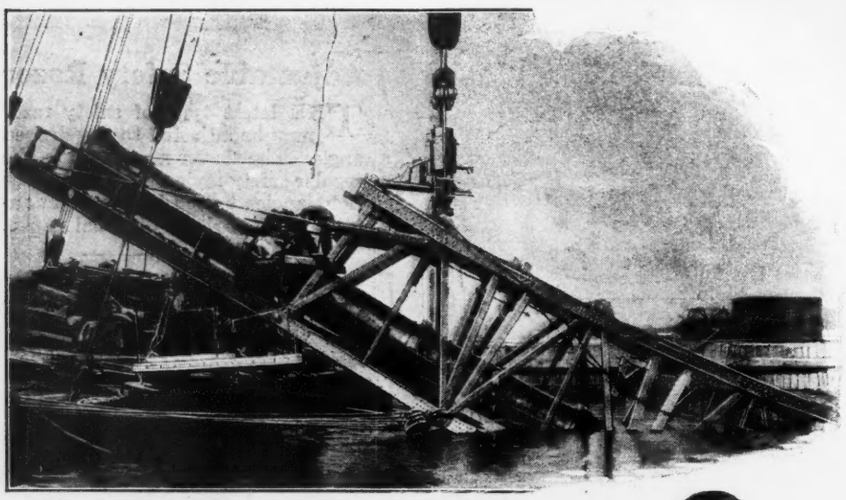
Perfect Noiseless Plane

BRITISH aviation experts are reported to have virtually eliminated the deafening roar of airplanes in flight. By a new invention it is said that exhaust gases are permitted to escape noiselessly without lessening power or speed. A noiseless propeller also has been devised by an ingenious arrangement of gears.

Swedish City Has Fresh-Air Telephone Booths

EVERY one who has been cramped in poorly ventilated drug-store telephone booths, can appreciate the cleverness of the Swedish inventor who thought of putting public telephones in boxes out of doors, on convenient street corners.

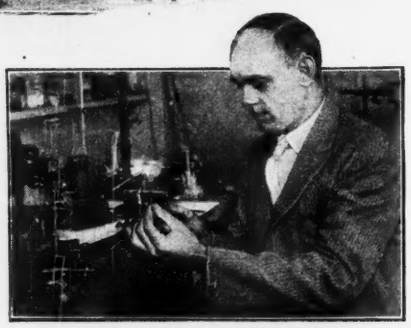
The booth illustrated above is of the latest design, erected recently by municipal authorities in a large city in Sweden. Open lattice-work admits fresh air.



Cradle Lays Pipe Line across Straits

TO SAVE time in laying a pipe line from Hetch-Hetchy, the water supply source for San Francisco, Calif., across the Dumbarton Straits of San Francisco Bay, engineers recently devised and employed the huge tilting cradle pictured above. So quickly and accurately does this mechanism place the pipe in position, that the engineers planned to complete the job in 60 days.

The photograph shows one section of the pipe being lowered.



George Taylor of the U. S. Department of Agriculture, holding the finest wire

World's Finest Wire Is Too Small for Eyes to See

THE finest wire ever made, wire so slender that it cannot be seen with the naked eye, was manufactured recently by George Taylor, a physicist in the United States Department of Agriculture. In the photograph at the left he is seen at work in his laboratory.

Wire of this kind is not only a novelty, but a practical commodity. Among those who use extremely fine wire are surgeons and dentists.

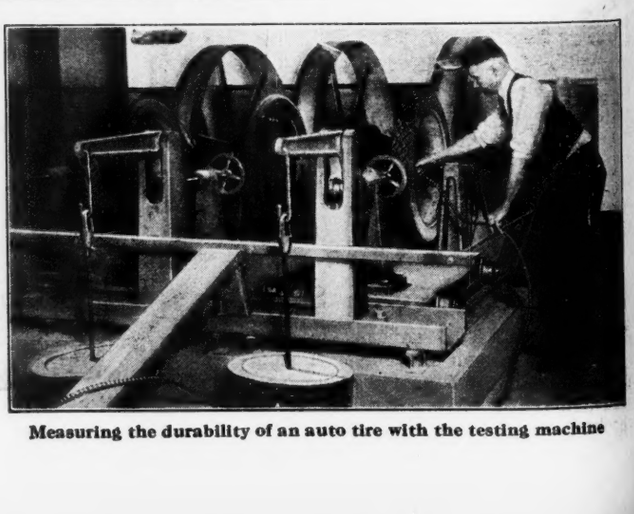
AN EXTENSIVE business in disinfecting public telephone apparatus once a month with a new preparation called "neroform" recently has been developed.

Machine Predicts Tire Life

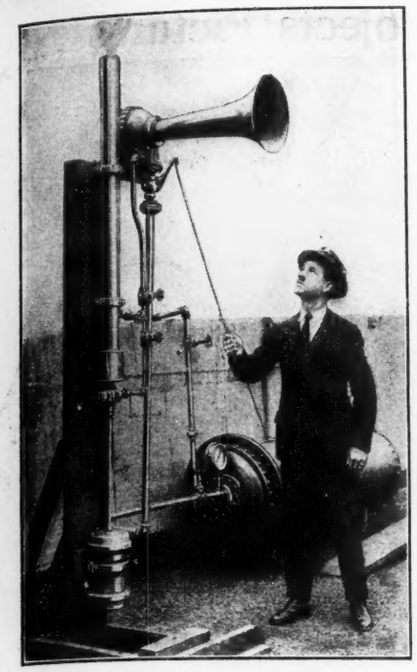
HOW long will your new tire last? It is to the manufacturer's interest to know the answer to that question before the tire leaves the factory. A machine for testing the durability of automobile tires, making accurate predictions of the service they will give, has been devised recently by experts of the U. S. Bureau of Standards at Washington, D. C.

A tire is run under standard conditions against the rim of a wheel provided with bumps. After a certain time the tire is examined for signs of failure. Weak points in the tires show up in a very short time, often in as little as two days. In actual service such a tire might last from six months to a year.

Tests are made also to determine whether the chemical and physical properties of the materials are those required by the specifications and found to be necessary for the construction of durable tires.



Measuring the durability of an auto tire with the testing machine



Motor-Ship Whistle Made to "Smoke" without Steam

THE advent of the motor-ship, using Diesel oil-burning engines instead of steam, presented a real problem in the matter of adequate whistles; for the usual puff of steam that told the pilots of other ships where the whistle came from was lacking. Compressed air employed to operate the whistle produced plenty of noise, but no visible signal.

The problem was solved recently when a motor-ship engineer conceived the idea of using a tank of liquid smoke, like that used in airplane sky-writing, in conjunction with the compressed air. This smoke pours forth every time the whistle is blown.

The ingenious new invention is pictured above.

Illuminated Sign-Posts to Aid Tourists

ILLUMINATED sign-posts to direct motorists on unfamiliar roads at night as well as in the daytime were exhibited recently at a national convention of American road-builders in Chicago. The signs can be read in the sunlight as clearly as when illuminated at night.

They will be placed at many important junctions on public highways, where they will aid tourists by giving directions.

© U. & U.

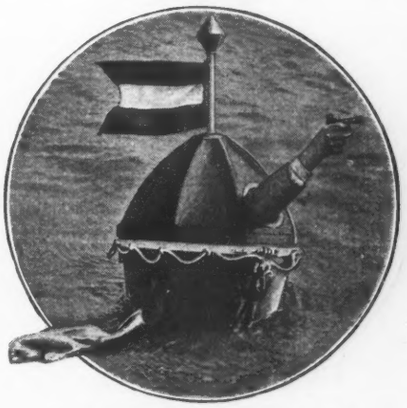
How the signs appear at night

Unique Lifebuoy Rides Heavy Seas

IN AN ingenious new life-saving buoy, recently tested successfully in the North Sea, the victim of a shipwreck can survive in safety and in comparative comfort as long as his provisions last, the inventor claims.

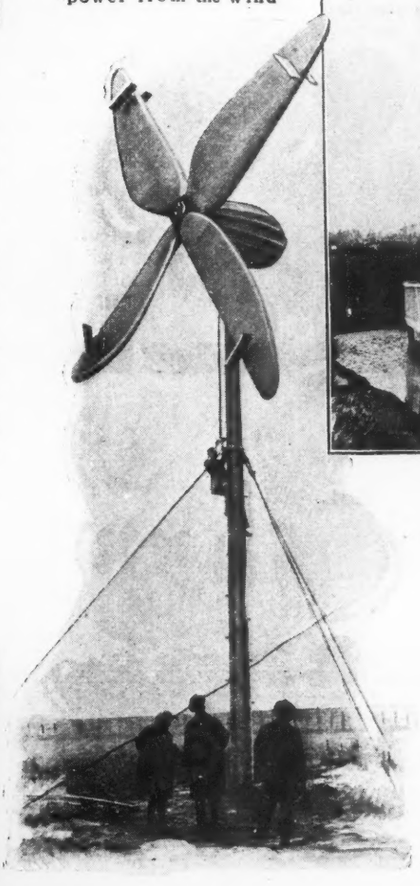
The buoy with its passenger rides easily over the waves, even in severe storm, it is said. A porthole in the upper part of the device can be opened and closed. It is just large enough for the occupant to thrust his arm through and fire a pistol to attract attention, as shown in the photograph.

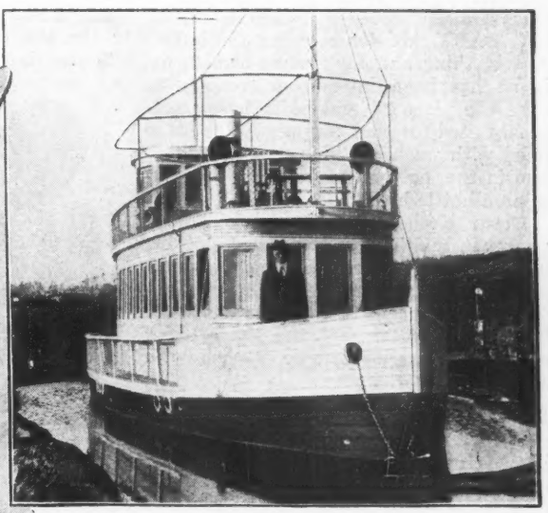
THE next eruption of the volcano Etna may be heard by radio throughout Europe and possibly in America. Signor Marconi is establishing a new radio station on the rim of its crater and purposes to broadcast its mutterings.



The occupant of the lifebuoy is able to thrust his arm through the porthole to fire a distress signal if help is near

Below is a new type of mill designed to catch more power from the wind





Dry-Land Houseboat "Sails" on Artificial Lake

WHILE he lived on a hilltop, H. A. Heroux, of Oakland, Calif., longed for sea life. So he built a house in the shape of a boat, surrounded it with an artificial lake, and now enjoys cool breezes from the deck of his unique home.

In the heaviest of storms the occupants have no fear of seasickness since the house is stationary, having a concrete foundation.

It cost the skipper-owner, who is shown in the photograph above, $20,000 to construct his odd boat-house.

Turns Wind Power into Electric Current

IN THE design of a revolutionary new type of windmill called the "aerodynamo," which converts wind power direct into electric current, Major Bilau, a German inventor, believes he has discovered a valuable source of economical power.

It is claimed that the aerodynamo can utilize 50 per cent of the wind's energy. It differs from previous windmills in the fact that the wind wheel is placed to the lee of the tower or mast supporting it. A vane of special design, placed to the windward, sweeps the wind directly to the back of the wings, where it can exert the most power. In previous types of mills the wind stream has been broken up behind the wheel, where the vane has been located. Thus much of the wind's energy was lost.

The photograph shows the arrangement of wheel and vane; also the small vanes that are attached to the wings and that add to their power.

Sanitary Kit for Baby's Bottles and Wardrobe

A BABY kit for carrying the baby's clothing and milk when away from home has been introduced recently to take the place of makeshift bags, commonly used for that purpose. The kit is lined with washable blue or pink rubber and in the bottom of the case are aluminum bottle holders.

Clean clothes may be packed in a pocket in the lining, while soiled clothing is carried in a rubber pocket entirely outside the bag proper, a notable sanitary feature. This compartment is removable. The bag is waterproof and the exterior as well as interior can be washed with soap and water.

Know Your Car

ONE of the best ways to start the motoring season right is to give your car a thorough cleaning. This should include the top and upholstery, too often neglected.

Sweep off the top first. If the top is leather, a mixture made of half a cup of turpentine, half a pint of raw linseed oil and four cups of water is a good cleanser. Apply with a clean rag and rub dry.

For mohair tops make a lather of a pail of tepid water and a bar of Castile soap. Use a large, clean sponge and wash the top well. Go over it with clear water to prevent streaking.

Plain water with a little ammonia will remove dirt from leather upholstery, after which the cushions should be rubbed with a clean woolen or flannel cloth. Do not use gasoline on leather.

Cloth upholstery may be cleaned by rubbing it with a sponge dipped in the following mixture: Three-quarter ounce common salt, two ounces grain or wood alcohol, mixed with clear water. Lukewarm ivory soapsuds will remove grease or oil spots.

Clean all glass windows and reflectors with a mixture of half alcohol and half water.

Pocket Light Projects Pictures

ONE of the latest novelties in entertainment is a small picture projector that can be carried in the pocket. The light necessary for projection is provided by an electric flashlight, and pictures can be thrown on any white surface. When in use, a telescoping lens is extended from the case. Tiny slides are inserted in the usual way. Although the entire outfit is hardly larger than a pocket flashlight, the pictures are said to be reproduced sharply and clearly.

In the photograph, the picture of a lioness is projected on a smooth wall.

Projecting the picture of a lioness on a white wall

AN AVERAGE of 30 per cent of the available power of gasoline for motors is being wasted by its discharge in the engine exhaust in the form of combustible gases, according to recent government tests.

Fun for One on Spring Seesaw

FOR the child without a playmate an ingenious new mechanical seesaw operated with a spring, will provide hours of entertainment. No one is needed at the other end. The spring retards the descent of the child, and helps to pull him up again after his feet touch the ground.

The teeter is operated by the child's pushing the ground with his feet, or it can be swung with a body motion. It is equipped with a comfortable saddle and with handles to prevent the possibility of the small child's falling off. It can be moved easily from place to place.

A spring balances the lone rider on this ingenious new seesaw

Wires Made Fireproof

FIREPROOF insulation for telephone switchboard wires is made possible by a newly discovered use for selenium, an element hitherto used chiefly in the control of electric current by light. The flameproofing of switchboard wires is highly important, for even a small fire can throw a whole exchange out of commission.

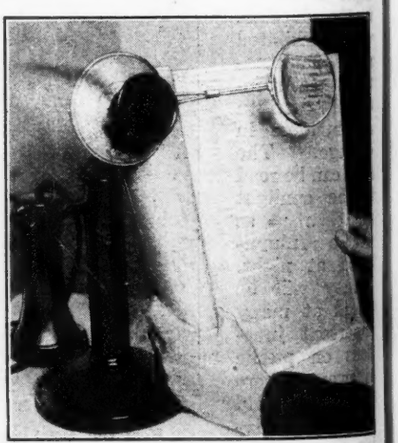
Phone Numbers Magnified by Glass Attachment

A MAGNIFYING-GLASS that can be attached to any telephone aids in reading small type numbers in the telephone book. It folds out of the way when not in use.

Wet Coal Is Costly

RECENT tests by the U. S. Bureau of Mines show that the wetting of coal is expensive to the consumer. Fine sizes of both bituminous and anthracite will hold up to 20 per cent in moisture, though larger sizes of the bituminous increase but little in weight when dampened.

Coal can have a perfectly dry appearance, yet still contain as much as 10 per cent moisture, for which the consumer pays. A moisture content of 12 per cent is not at all uncommon.



How the magnifying glass is attached

Compact Sterilizer Aids Dentists

© U. & U.

The new sterilizer held by the inventor, Dr. P. L. Nemmers

A DEVICE that keeps drills and other attachments used in dental work continuously sterilized is the invention of Dr. P.L. Nemmers of Chicago, Ill. For its compactness and the ease with which it is used it was commended by dentists at a recent national dental convention.

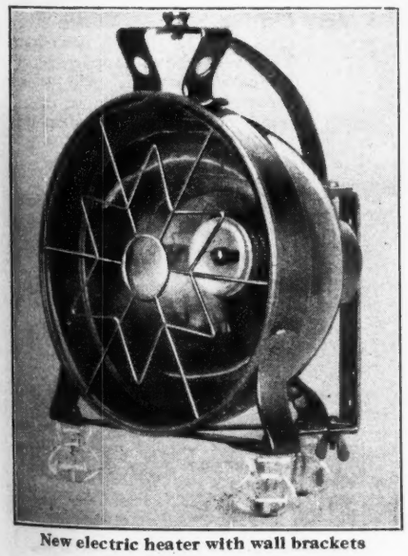
RECENT tests show that silk thread used in stringing pearls should not be dyed nor contain chemicals, otherwise the luster of the pearls may be destroyed.

Portable Electric Heater Useful as a Lamp

BECAUSE of the unusual shape of its reflector a compact new brass electric heater is said to focus intense heat in a given direction instead of diffusing it as does the usual bowl-shaped type of heater. For quickly heating small rooms, such as a bathroom or nursery, this feature is said to be advantageous, when time is important.

Its heating element is of a screw socket type that is easily renewable. An electric-light bulb can be substituted for illumination, if desired, the reflector producing a powerful beam of light.

The heater rests on heavy glass supports. It is equipped also with an adjustable metal bracket with screw holes, by which it may be attached to the wall in any desirable place. It is provided also with a 15-foot extension cord. It can be used on either direct or alternating current.



New electric heater with wall brackets

Chicago Churches Install Offering Safes

DURING a crime wave in Chicago recently the collection boxes in so many churches were stolen that specially designed burglar-proof offering safes were installed in 30 churches.

Three slots in the top of the safe are provided to receive as many kinds of offerings, which drop through chutes into compartments reserved for them. Sharp teeth at the end of each chute prevent the possibility of a thief's stealing the coins by lowering a sticky substance on a string from outside. The safe is of extremely heavy construction to prevent any attempt to remove it bodily.

Concrete Surfacing Tool Driven by Motor

FINISHING the surface of concrete after the rough work is completed, removing irregularities, and preparing the surface for painting are hand processes that long have been expensive. A simple new portable surfacing machine driven by electricity recently has been perfected to do the work in much less time. Its fine cutting action is said to produce a much better surface.

The machine can be used also to produce special finishes on imitation stone, to cut brick walls preparatory to applying stucco, and to grind paint from bricks. In use, the motor hangs at the side of the worker, and is slung from a strap over his shoulder, leaving both hands free to operate the light power tool.

How Much Science Do You Know?

HERE are a dozen simple questions such as might be put to you any day. How many of them can you answer intelligently?

Answer each one to the best of your ability, then turn to page 144 and see how nearly you were right.

Twelve more questions will appear in next month's issue.

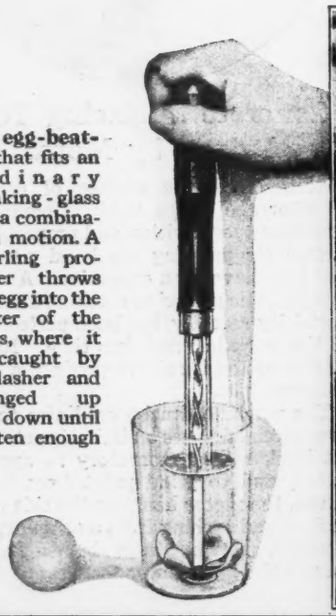
1. **How much water is there in an inch of rain?**
2. **Why can deaf persons sometimes hear through their teeth?**
3. **What are phonograph records made of?**
4. **Why do bubbles collect inside of a glass of water standing in a warm room?**
5. **What do fishes eat?**
6. **Why is the moon sometimes seen in the daytime?**
7. **Why do moth balls get smaller and finally disappear when put away with clothes?**
8. **Can elevator motors interfere with radio reception?**
9. **Will the earth ever stop spinning?**
10. **Why does being near a dynamo sometimes spoil your watch?**
11. **What is a candlepower?**
12. **Why do people yawn?**

Science Eases the Labor

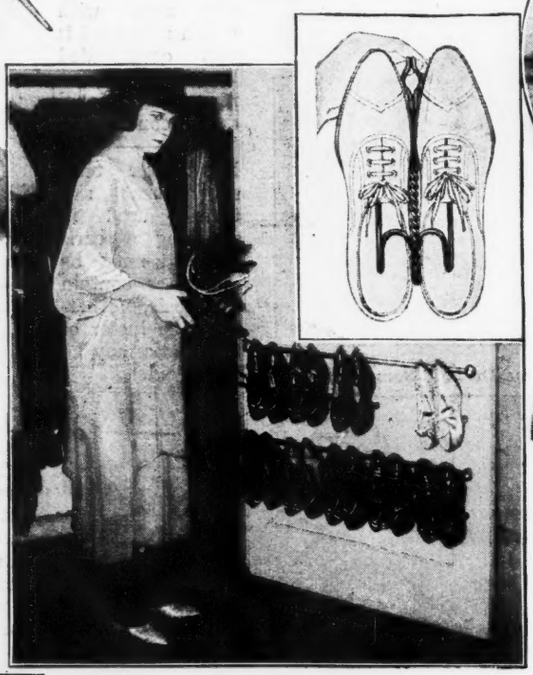
New Fixtures for Kitchen and Bedroom

The flexible metal nozzle of the oilcan at the left makes it invaluable for reaching awkward corners in the carpet-sweeper's or the vacuum cleaner's out-of-the-way joints

Slicing eggs or beets can be accomplished neatly and quickly by this device, which is made of a grid of fine wire that is pressed through the food

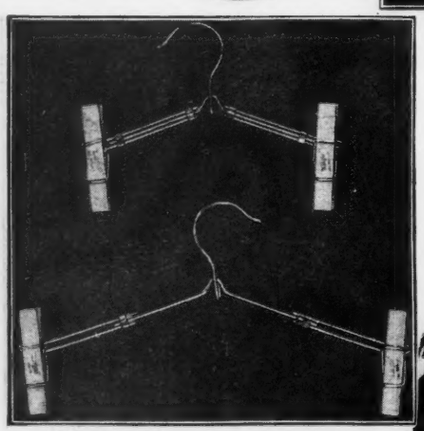


An egg-beater that fits an ordinary drinking-glass has a combination motion. A whirling propeller throws the egg into the center of the glass, where it is caught by a dasher and plunged up and down until beaten enough

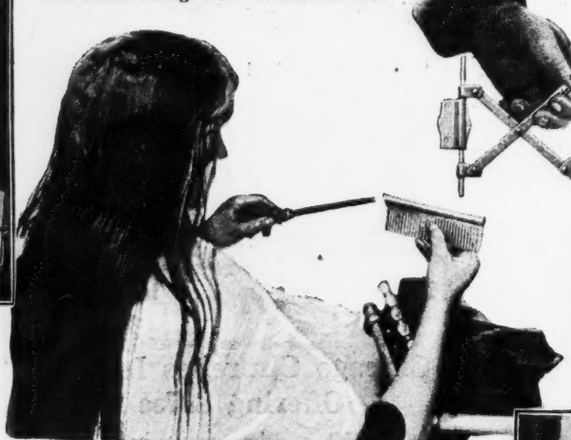


Double shoe-trees keep shoes together on a hanger. Pressure is exerted from arch to toe, leaving no strain on the heel. A small hook in the center hangs the trees on the rack

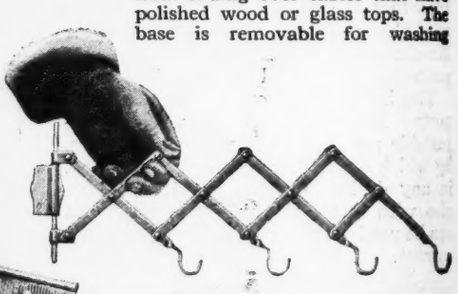
A rubber base with small projections keeps this new sugar dispenser from sliding over tables that have polished wood or glass tops. The base is removable for washing



This collapsible clothes-hanger is useful for hanging dresses, coats, or trousers. The sliding sides are adjustable to several sizes and allow easy packing. The top hook folds in

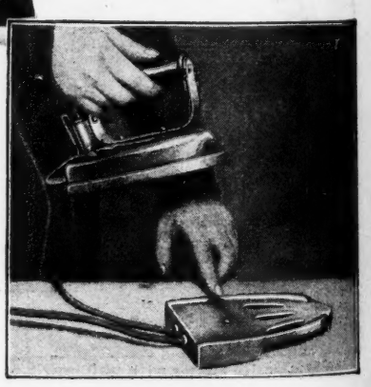


A hair-drying comb will prevent colds after shampooing. One part of the comb is heated, then inserted into the comb proper, which being of aluminum, readily conducts the heat



Clothes-hangers to suit every need can be found nowadays. The one above is particularly useful because it will swing three ways and collapse or expand as the occasion demands

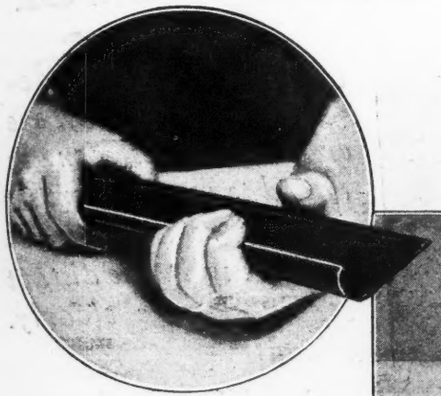
Keeping a comb clean is an easy matter with the device shown above. It is held like a razor strop, hooked at one end to an adequate support



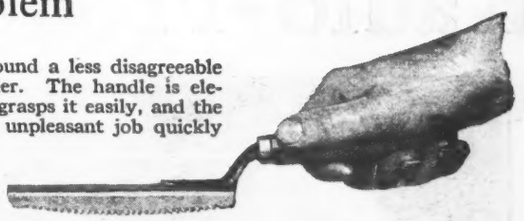
An automatic stand for the electric iron prevents overheating of the iron, as the current runs only while the iron is in use or off the stand

of the Modern Housewife

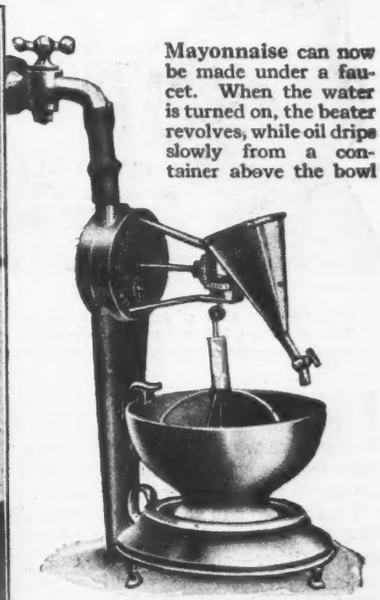
Simplify Many a Home-Making Problem



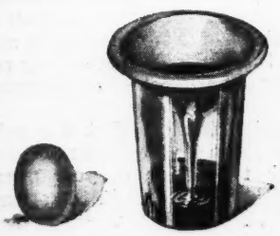
To prevent drafts, a light, strong strip of bent metal is designed to be slipped under the door and fastened by two screws. Tightening the screws adjusts the strip to its frame



Fish-scaling will be found a less disagreeable task with this new scaler. The handle is elevated so that the hand grasps it easily, and the many teeth finish the unpleasant job quickly



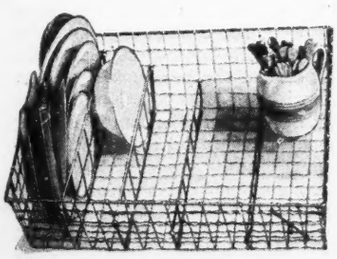
Mayonnaise can now be made under a faucet. When the water is turned on, the beater revolves, while oil drips slowly from a container above the bowl



A cone-shaped aluminum egg-separator that fits on top of an ordinary tumbler, prevents broken yolks. The white runs slowly through a slotted section, leaving the yolk in the top of the metal separator

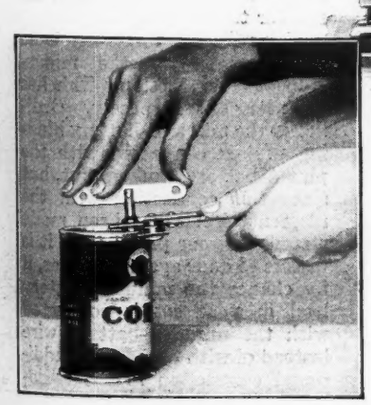
A stool in the kitchen means rest for the housewife. This white enameled seat that swings in under the sink will save nerves and backache and insure cheerfulness and added efficiency

This built-in garbage receiver is convenient and sanitary. When the door is opened, the can swings out with it. The hinged metal door keeps in unpleasant garbage odors

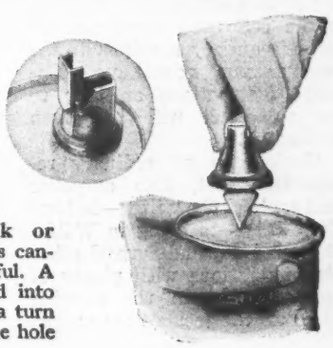


This new dish-dryer has graduated bins that keep delicate and heavy china separated, preventing much unsightly chipping

Even children can grade eggs with this new invention. When an egg is put in the grader, the beam automatically adjusts itself. The lowest visible number indicates the weight of one dozen eggs of the same content



This safety can opener keeps the can at a distance. Turning the key clockwise makes the can revolve, and a sharp-edged steel wheel neatly cuts off the top



For condensed-milk or syrup containers this can-opener and spout is useful. A sharp point is pressed into the lid and given half a turn to fit it snugly into the hole

How to Build a Radio-Frequency Amplifier

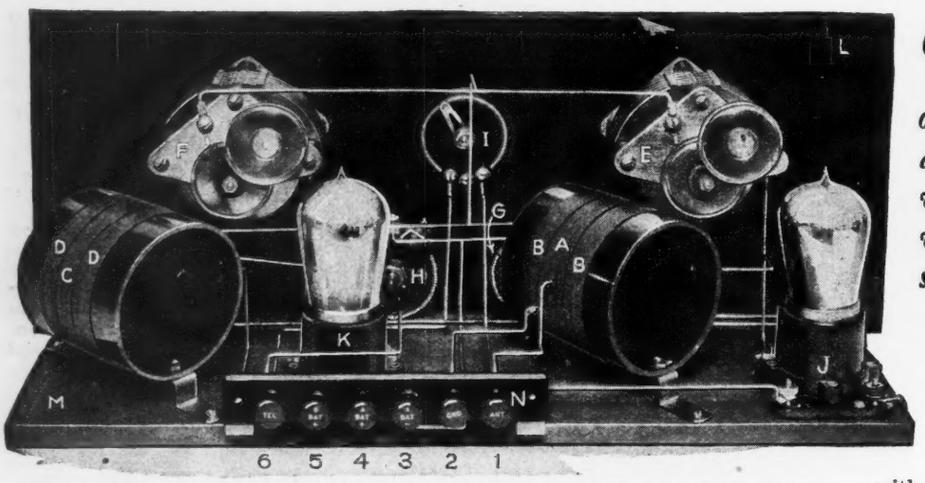


Fig. 1—Rear view of two-stage radio-frequency amplifier, showing layout of parts and wiring. The parts are lettered and numbered to correspond with wiring diagram below. Note brass brackets supporting the tuning units. These were made by bending the ends of right-angle brackets

THIS simply designed unit of one or two stages can be added to your present set without rebuilding. It will bring in the distant stations more clearly.

By Alfred P. Lane

IF YOU already have built a regenerative receiver, the chances are that you are wondering how you can add radio-frequency amplification without having to rebuild your whole outfit.

This article will show you how to do it. And there is nothing tricky about the circuit either—anybody who can get a regenerative receiver working properly will have no trouble at all in adding two stages of radio-frequency amplification to his set.

Do not build this radio-frequency amplifier with the idea that it will increase the strength of the signals from powerful local stations, for if you already use a good outdoor antenna, there will be no appreciable increase in the volume; that is not its mission.

Radio-frequency amplification will be a big help, however, in bringing in distant stations, and—what is still more important to many radio fans—it will greatly increase the selectivity so that you will be able to get the distant stations right through the locals when conditions are at all favorable. If you follow the instructions carefully, you should have a set that will give the greatest satisfaction.

The Parts You Need:

A and *B*—First tuning unit
C and *D*—Second tuning unit
E and *F*—Variable condensers, .0005 mfd. maximum capacity
G and *H*—Rheostats
I—400-ohm potentiometer
J and *K*—Vacuum-tube sockets
L—Panel, 7 by 18 inches
M—Wooden baseboard, 6 by 17 inches
N—Binding-post strip, ¾ by 6 inches

Two pieces of composition tubing, 3 inches in diameter by 3 inches long; two dials (if they are not included with the variable condensers); six binding posts, brass right-angle brackets, bus wire, and wood screws.

FIGURE 1 shows a wiring diagram of the radio-frequency amplifier, and you will note at the right a coil marked *X*. This is the coil used to couple the radio-frequency amplifier to the receiver you now have. Detailed instructions on how to use this coil will be given further on.

Hooked to an ordinary regenerative set, this amplifier unit enabled the writer—in New York City—to bring in WTAS at Elgin, Ill., and several other distant stations with plenty of volume early in the evening when all the locals were on the air. The same stations could not be tuned in on the regenerative receiver alone without considerable interference from the local stations.

The radio-frequency-amplifier unit adds two tuning controls, to be sure, but since it eliminates the need for a tickler in the regenerative set and also dispenses with antenna tuning where this is used, the total number of tuning controls remains at three—the two dials of the radio unit and the dial of the secondary condenser or grid variometer in your present set.

It is quite possible that the radio-frequency amplifier as illustrated does not match the design of your present receiver either in size or in the arrangement of the binding posts.

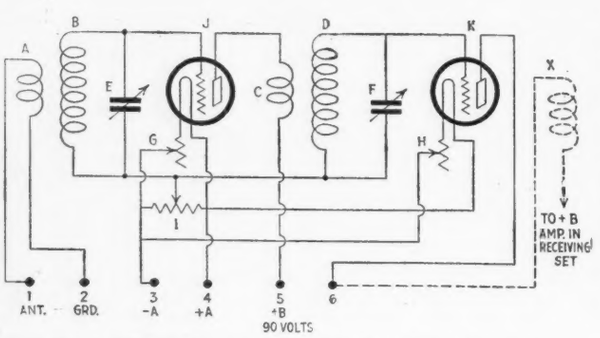


Fig. 2—Wiring diagram. The coil *X* is built into your receiver, as shown in subsequent diagrams (Figs. 7, 8, and 9)

THE panel *L* was made 7 by 18 inches because so many radio constructors favor this size and the binding posts are mounted at the back on strip *N*, since this is the style at present. If your receiver is built with the binding posts on the panel, you can follow the same style in the radio-frequency-amplifier unit by placing binding posts Nos. 1 and 2 at the left end of the panel, as seen from the front, with binding post No. 6 at the right end opposite the antenna binding post of your present set. Leave the remaining four binding posts, which are for the battery connections, where they are shown in Fig. 1.

The radio-frequency-amplifier unit will give best results with ¼-ampere storage-battery tubes and 90 volts of B battery; but dry-battery tubes can be used with satisfactory results, although it may be necessary to add three or four turns to coils *C* and *X* when the smaller tubes are used.

You will note that there is no binding post for the minus-B-battery connection. This has been left out purposely. Ordinarily the minus-B-battery binding post is connected with the plus-A-battery binding post, but since this connection with the filament circuit has been made already in your present set, it is useless to do it again. Besides, if by chance the minus-B-battery lead in your set is connected with the minus-A-battery wire instead of with the plus, an additional connection in the radio-

frequency-amplifier unit might short circuit your storage A battery with rather disastrous results to the wiring, to say nothing of the effect on the battery itself.

THE tickler coil, or plate variometer, should be cut out of the plate circuit of the detector tube in your set when used with this radio-frequency-amplifier unit because you can get the set up to the point of oscillation on any wave length by adjusting the potentiometer *I*.

There are many other ways to control oscillations in radio-frequency amplifying circuits besides the potentiometer, and some of them could be used very well in place of this instrument in the amplifier as constructed. However, the potentiometer arrangement is foolproof, and a slight adjustment of it will compensate for variations in different tubes, coupling between stages, and so forth.

The use of a separate rheostat for each tube is worth while, since often two tubes have slightly different characteristics. One tube may require a bit more current than the other for best results.

Those fans who desire to build a one-stage radio-frequency-amplifier unit instead of a two-stage can do so very easily. Just eliminate parts *C* and *D*, *F*, *H*, and *K*, and connect the plate terminal of socket *J* with binding post No. 6 instead of with coil *C*.

THE parts you will need are listed on page 74.

The sockets *J* and *K* and the rheostats *G* and *H* should, of course, be chosen to suit the tubes you use. A 200-ohm potentiometer will do just as well as the 400-ohm one specified, although the higher the resistance of the potentiometer, the less current it will drain from the A battery.

After you have bought all the parts, lay out the panel according to the diagram in Fig. 4. Note that only the location of the holes for the shafts of the instruments is given, since so many instruments are single-hole mounting, and the ones that require holes for mounting usually are supplied with templets. The easiest way to drill the panel without scratching it is to mark off the locations of the holes on a piece of paper the exact size of the panel. Then paste the paper on the panel with library paste and drill the holes right through the paper after you have made a deep center punch mark for the center of each hole. After the holes are drilled the protecting paper can be washed off.

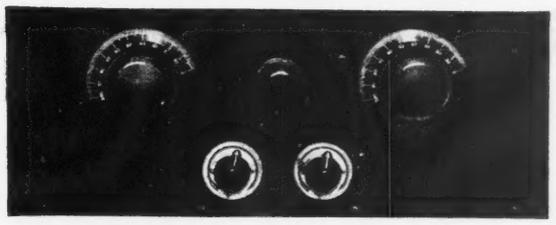


Fig. 3—Panel layout. The knob controlling the potentiometer *I* is shown between the two condenser dials. It controls oscillation. Place the binding posts on panel if you so desire

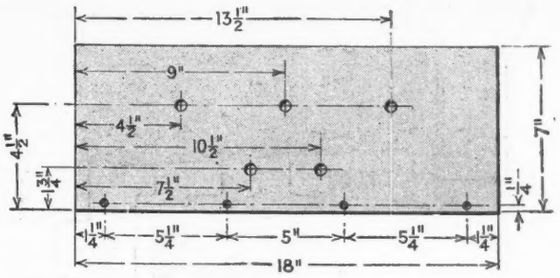


Fig. 4—Diagram for drilling the panel, with exact measurements indicated. Only the holes for shafts are given. Lay out holes for supporting screws from templets supplied with the instruments

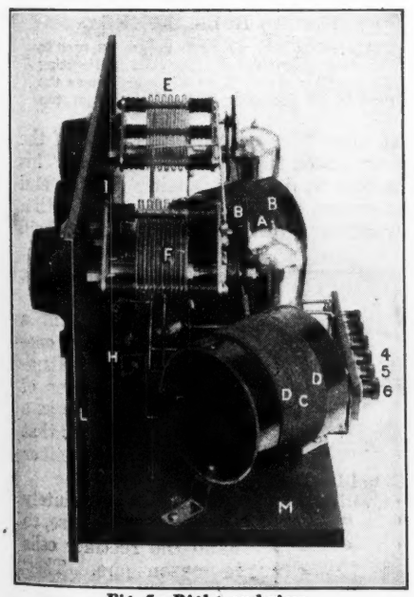


Fig. 5—Right-end view

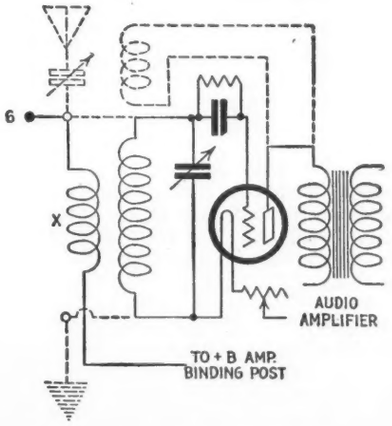


Fig. 7—This wiring diagram shows how to connect the radio-frequency-amplifier unit with a single-circuit set. Coil *X* should consist of four turns of bell wire wound around the secondary coil. All parts and wires shown in dotted lines should be eliminated

The panel is fastened to the baseboard by means of four round-headed wood screws. The locations of these screw holes are included in the panel layout in Fig. 4. Mount the instruments on the panel as shown in Figs. 1, 5, and 6. It is well to set the condensers *E* and *F* with the plates up instead of down to allow more room for the coils.

The winding of the coils is the next step. They are wound on composition tubing 3 inches long by 3 inches in diameter and mounted on the baseboard by means of brass brackets, as shown in Figs. 4, 5, and 6. Coil *A* consists of 8 turns of No. 22 double silk-covered wire centered on the tube. The terminals of this coil are brought out as shown in Fig. 1, where they are convenient to binding posts 1 and 2.

Coil *B* consists of 25 turns on each side of coil *A*, with the inside ends of the two sections soldered together inside the tubing. The direction of winding makes no difference in any of the coils except that the two sections of coils *B* and *D* must be wound so that the current flows in the same direction around the coil from one end to the other.

THE simplest way to fasten the ends of the wire is to drill two small holes about one-quarter of an inch apart where the end of the wire is to come, and pass the wire through and back. The two pairs of holes for the ends of coil *A* should be one-quarter inch apart and the two holes for ends of coil *B*, which are nearest to coil *A*, are naturally the same distance apart.

Only two holes are necessary for the two ends, since they are soldered together inside the tube as shown in Fig. 1. Each half of the winding of coil *B* is three-quarters of an inch long and you can drill the four holes for the outside ends of coil *B* on the opposite side of the tube 1¾ inches apart.

Tuning unit *CD* is just like *AB*, except that all the wire ends are brought out on the same side. Coil *C* consists of 4 turns of No. 22 double silk-covered wire and coil *D* is wound with 25 turns on each side of coil *C*.

After you have mounted the tuning units *AB* and *CD*, the sockets *J* and *K* and the binding-post strip *N* with six binding posts screwed to it, all on the baseboard *M*, as shown in Figs. 1, 5, and 6, you are ready to proceed with the wiring.

The coils *AB* and *CD* should be set on the baseboard so that the axes of the coils make an angle of about from 55 to 60

(Continued on page 149)

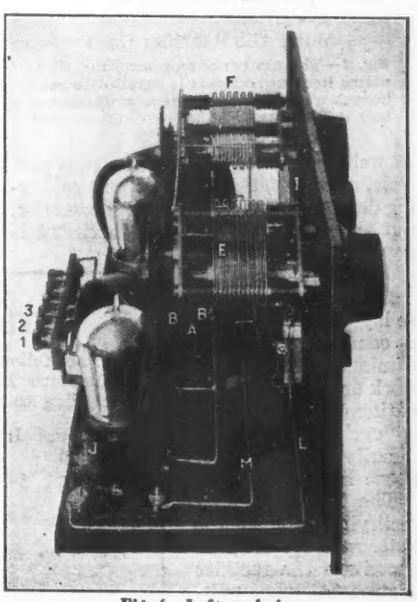


Fig. 6—Left-end view

Alternating Light Current Will Do the Work of B Batteries

This Filter Circuit Should Cost Less than $10 to Build

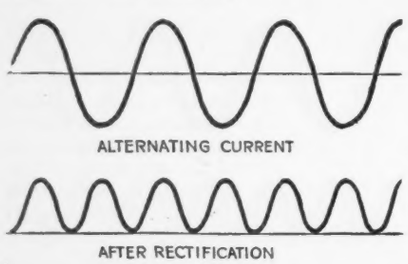
By Alexander E. Senauke, M.E.

IN PREVIOUS articles in POPULAR SCIENCE MONTHLY, I have shown how to use farm lighting current and ordinary direct current from the street mains for supplying the B-battery voltage needed by radio receiving sets.

In this article I shall describe how you can use alternating current for the same purpose. This method is relatively more important because the majority of radio fans throughout the country are located where only alternating current is available.

The first step in arranging to use this current for your radio set is to rectify it. Figure 1 gives a good idea of the result of this operation. At the top is a curve representing alternating current supplied to your house, and just below it is another curve showing the current as it leaves the rectifier.

You will note that none of the diagrams show how to use alternating current as a substitute for the A battery as well as for the B battery. It is possible, of course, to build a current-rectifying device that will eliminate all batteries, but the construction of such a circuit is beyond the scope of ordinary amateur work.

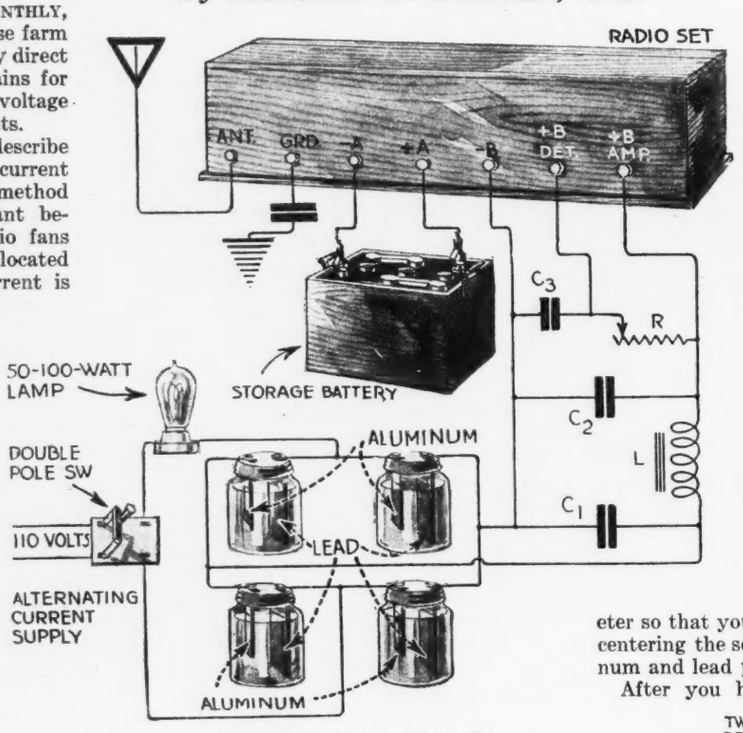


What the Rectifier Does

Fig. 1—The top curve represents the alternating light current that is supplied to your house, while the lower curve illustrates how it leaves the rectifier as direct current

Figure 2 shows how to lay out and hook up a complete B-battery eliminator that will work on 110-volt alternating current of 50 or 60 cycles such as ordinarily is supplied for house lighting.

The four mason jar rectifying cells at the bottom of the diagram constitute the rectifier portion of the unit.



The Hook-Up to Your Set

Fig. 2—This diagram shows how to wire the parts of the rectifier and connect it with your set. The values of the inductance, resistances and condensers you will need are given in the table at the foot of the page

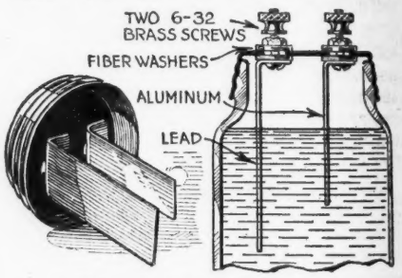
Standard one-pint jars are very satisfactory. The way to fasten the lead and aluminum plates to the cap of the jar is shown in Fig. 3. The aluminum plates should be made of the purest material obtainable and the area of aluminum below the top level of the solution in the jars should not be more than one square inch. The size of the lead plates is not important—two or three square inches of sheet lead will do for each cell.

The solution in the jars should consist of distilled water in which has been dissolved as much ordinary borax as the water will take.

A house-furnishing store will sell you the mason jars, the grocery store keeps borax in stock, and the plumber can supply the sheet lead and the fiber washers, shown in Fig. 3, which are used as insulators. The pure sheet aluminum is not so easy to obtain, but your hardware dealer will put you in touch with a source of supply if he has none in stock. The total cost of the four cells ready for use should be less than one dollar.

THE porcelain lining in the caps of the mason jars should be broken out with a light hammer and then the holes drilled as indicated. Make the holes at least one quarter inch in diameter so that you will have no difficulty in centering the screws that hold the aluminum and lead plates to the tops.

After you have the cells assembled,



How to Build the Cells

Fig. 3—Standard pint mason jars are used in constructing each of the four cells constituting the rectifier unit. This diagram shows the method of attaching the plates to jar top

test them to make sure that none of the screws touch the metal of the cap. This can best be done by putting the cap and the screws, one at a time, in series with a dry cell and an ordinary buzzer or bell. If the bell does not ring, there is no short circuit.

Be sure to drill a small hole about one-sixteenth inch in diameter in the center of each cap to serve as a vent for the gases that form while the rectifier is in operation.

It is not absolutely necessary, of course, to build the rectifier cells in mason jars. They

(Continued on page 151)

The Values to Use with Your Set

The following table tells you the values you will require for the inductance *L*, the condensers C_1, C_2, and C_3, and the resistance *R*, according to the number of tubes in your set:

Number of Tubes	Inductance of L	Allowable D.C. Resistance of *L*	C_1	C_2	C_3	*R*
3	5-20 henries	2000 ohms	2 mfd.	4 mfd.	2 mfd.	5000 to 10,000 ohms, variable
5	"	1500 "	4 "	4 "	2 "	" "
7, 8, or 9	"	1000 "	6 "	8 "	2 "	" "

The Month's Novel Radio Ideas

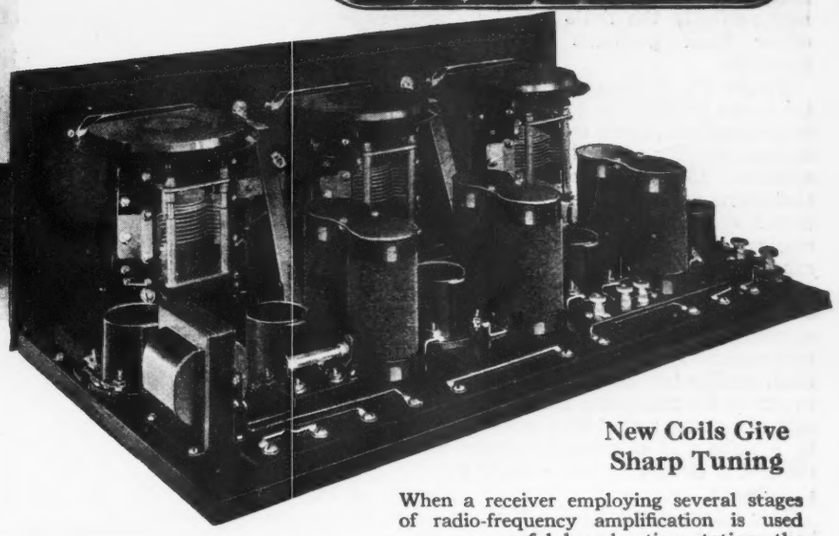
New Inventions for Receiving Sets and Broadcast Stations

Tiny Station

Although thousands of amateur radiophone stations use power as low as five watts, WDBX in New York City is the only regularly licensed radio broadcasting station in America with only one five-watt tube to supply energy to the antenna. Samuel McMullen is shown at the relatively tiny control board of WDBX

Grandfather's Clock Up to Date

This modern version of the grandfather's clock attracted considerable interest at the first radio show ever held in Germany. It is wound automatically and is set for the German standard time by radio. A loudspeaker for broadcast reception is just below the pendulum, while a receiving set and battery compartment take up the rest of the space in the cabinet. In this view the tall door of the cabinet is open to give access to the neatly arranged radio set

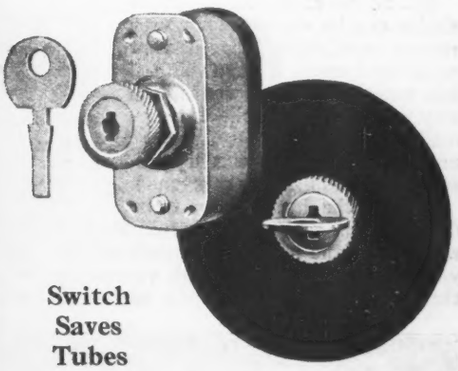


New Coils Give Sharp Tuning

When a receiver employing several stages of radio-frequency amplification is used near a powerful broadcasting station, the coils themselves act as loop antennas so that it sometimes is difficult to tune out the local station. One manufacturer claims to have solved this trouble by shaping the coils like a binocular and eliminating interstage coupling. Radio waves reaching the coils, except by the antenna, are balanced out

Giant Tubes for Oversea Radio

Here is one of the new water - cooled vacuum tubes that are being manufactured for the British Government wireless station at Rugby, England, to be used for radio communication with New York. They are said to be many times more powerful than any tubes now in use. The valves are tested with a current at a voltage of 15,000. The operator stands by with a cord connected with the power supply so that it can be shut off from the tubes instantly in case of an emergency



Switch Saves Tubes

Owners of radio receiving sets installed in homes where there are small children will appreciate the advantages of locking up the receiver when it is not in use. This switch lock takes the place of the ordinary switch operated by a button. The key turns off the filament circuit so that the set cannot be used

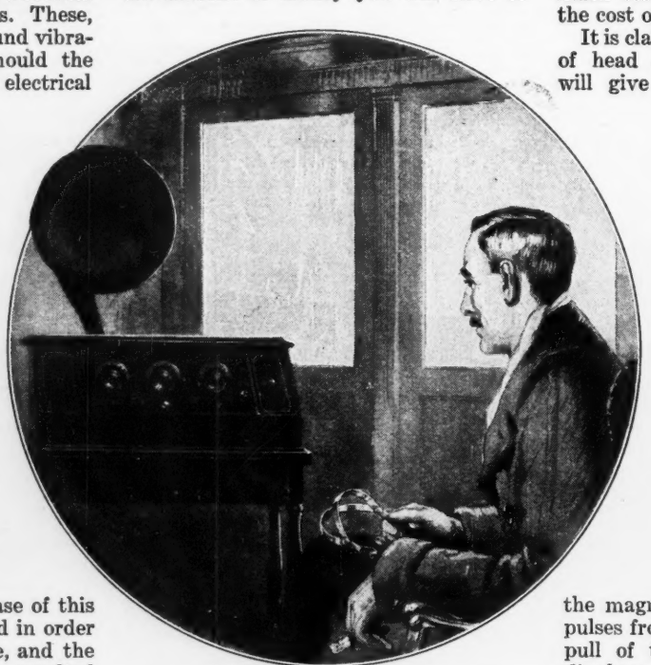
How to Select Your Loudspeaker

An expert helps you choose an instrument that will give undistorted reproduction of radio voices and music

By Arthur A. Stuart

AS FAR as quality of reproduction is concerned, the radio receiver and the loudspeaker are the Siamese Twins of radio. The former converts the high-frequency radio impulses into much more powerful electrical pulsations at audible frequencies. These, in turn, are transformed into sound vibrations by the loudspeaker. Should the radio receiver deliver distorted electrical impulses to the loudspeaker, the result is bound to be poor reproduction. And it is equally obvious that nothing but unsatisfactory speech and music can come from a low grade loudspeaker, no matter how perfectly the radio receiver itself performs its functions.

People who possess an ear for music naturally are in a better position to pass on the musical quality of a loudspeaker. It is unfortunate that some radio dealers apparently have no ear for music at all, judging from the raucous blare they persist in sending out over the public streets by way of loudspeakers installed in transoms over doors. In almost every case of this kind, quality has been sacrificed in order to attain the maximum volume, and the ears of passing pedestrians are assaulted by a noise well calculated to drive any thought of owning a radio receiver out of their heads.



You can judge whether a loudspeaker produces good quality by listening with head phones on the detector stage, then listening to the loudspeaker, and comparing the two

This brings out one point that is important—you cannot always rely on the dealer's opinion as to the best loudspeaker. It is a question you must decide for yourself, and if you have no ear for music you should call in some friend who has the ability to help you.

The advice of any reliable radio dealer can be depended on with respect to all other items of your radio equipment if you will tell him exactly what you want in the way of results, for the factory-made receivers of today are nearly all capable of excellent results as far as quality is concerned.

A typical homemade loudspeaker, consisting of an old phonograph horn to which is attached a single head phone. Such an outfit will give excellent quality of tone at low volume

Perhaps the first question to be decided is the matter of volume. Do you want to fill the house with music or will you be satisfied with enough volume so that you and your friends can hear clearly if you are in the same room with the loudspeaker?

This is a vital point, for upon it hinges the amount of money you will have to spend for a loudspeaker. Volume and quality do not go hand in hand. High quality with small volume is relatively easy to attain, but the minute you attempt to get the music or speech loud enough to be heard all over the house, distortion has to be compensated for in every possible way—and this means careful design, precise manufacturing methods, and much testing and adjusting. Naturally the cost of such loudspeakers is high.

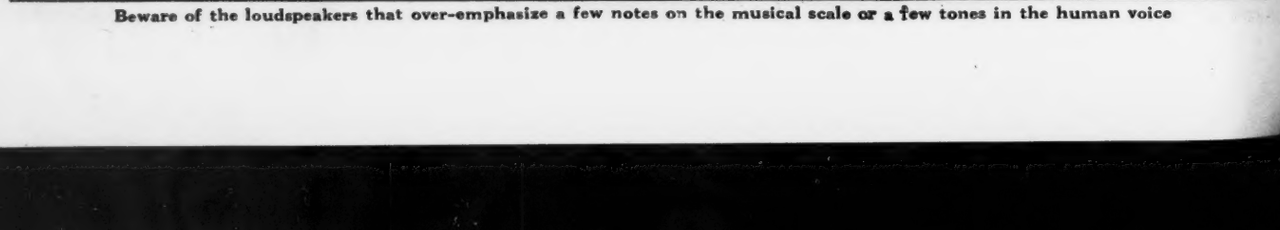
It is claimed by experts that a good pair of head phones costing less than $10 will give you as good, if not better, reproduction than can be obtained from the very finest loudspeaker money can buy. This is because the head phone is called on to give out sound vibrations of relatively small magnitude.

To understand what causes the distortion, it is necessary to know something of the mechanism used to transform the electrical impulses into sound vibrations in the air. The head phone is the simplest example. It consists of a permanent magnet arranged so that the poles of the magnet exert a constant pull on a thin disk of iron called the diaphragm. Coils of fine wire are placed on the poles of the magnet in such a way that the magnetic effect of the electrical impulses from the radio receiver change the pull of the permanent magnet on the diaphragm and it moves back and forth in time with the electrical impulses. The vibration of the diaphragm is what causes the sound waves in the air.

The permanent magnet naturally exerts the strongest pull on the diaphragm if placed very close to it, and this fact accounts for some of the distortion. Strong electrical impulses cause the iron diaphragm to vibrate so far that it bumps against the ends of the pole pieces with a chattering sound, and if the spacing is increased, the weaker impulses are lost altogether.

Many loudspeakers are equipped with an adjustment to regulate this spacing to compensate for loud signals, strong plate current, and so forth. In a number of models, the diaphragm is made of mica or aluminum connected with a small piece of iron, called the "armature," placed in the field of the permanent magnet. The connection

(Continued on page 148)



Beware of the loudspeakers that over-emphasize a few notes on the musical scale or a few tones in the human voice

What Does "Low Loss" Mean?

A much-abused radio term explained to safeguard you against inferior parts parading under false colors

By John Carr

SOME time ago, back in the dark ages of radio, a young man who was interested in amateur radio transmission and reception on the shorter waves, made a serious attempt to design a radio receiver for use on these waves with the idea of reducing some of the losses that were hampering his reception of distant signals.

He succeeded in working out a receiver that gave uncommonly good results, and in describing his outfit for one of the radio magazines, he hit upon a brilliant thought. He called it a "low-loss" receiver. Other amateurs experimented along similar lines, and before long "low-loss" construction was the main subject of conversation in amateur circles.

Manufacturers of radio apparatus quickly saw the advertising possibilities of such a catch phrase, and new pieces of radio apparatus designed for use on the broadcast wave lengths began to appear on the market tagged with the mystic words, "low loss."

Radio fans were interested at once, and soon it looked as if no maker of radio apparatus, regardless of the quality of his product, could possibly stay in the radio game unless he, too, brought out a line with the magic slogan on the boxes. And that condition exists today in spite of the fact that a number of the parts now on the market labeled "low loss" have no more rightful claim to the label than the man in the moon.

THERE is no mystery about the "low-loss" idea. A "low-loss" condenser is simply one that performs its electrical functions in a highly efficient manner. Because a variable condenser has metal end plates and a grounded rotor does not prove that it is electrically efficient. As a matter of fact, it may actually have greater losses than a condenser with molded end plates. Care in construction and the quality of the materials used are more important than any particular style.

Every new model brought out by a reputable manufacturer is quickly followed by a number of imitations. Outwardly, at least, two condensers may appear to be equally good, but one condenser may be insulated with the best material obtainable, while the imitation contains insulation like the original only in color and finish.

Spacing washers may be turned out by screw machines with perfectly flat, smooth surfaces on both sides, or they may be punched out in a press, with the result that they are burred on one side and bent on the other. After assembly, the punched washers are polished on the outside and they look well to the prospective buyer, whether they are making good contact with the plates or not.

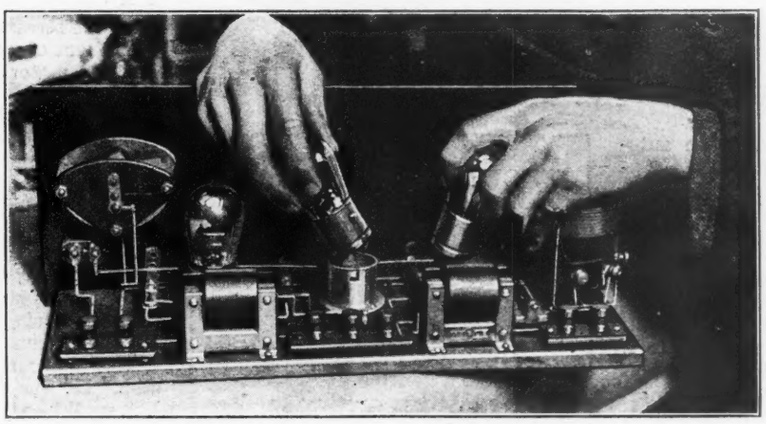
The qualities that entitle a variable condenser to be called "low loss" may be stated in a few words: Good insulation in the right place and not too much of it, accurately spaced plates making good contact with the shaft and fixed support, and rigid bearings.

The matter of bearings, by the way, is important both electrically and mechanically. We must rely on them to maintain the moving plates in permanent alignment with the stationary plates, and no condenser can be rated as first class unless the bearings have absolutely no side nor end play. Otherwise it will be impossible to be sure of always hearing the same station at the same point on the dial.

Good bearings also are of great importance in the actual operation of a receiver. A bearing that turns with a smooth, velvety motion makes close tuning possible without Vernier dials.

THE condensers made by reputable manufacturers vary somewhat as to electrical efficiency, but the differences are so small that even the poorest one of the lot still would bring in any signal that could be heard by the best one.

Nearly all tuning coils and inductances of various kinds now are labelled "low loss." And many of them are really exceptionally efficient. They are wound with the finest grade of wire, use the minimum amount of supporting insulation, and actually live up to the claims of the makers. Others are "low loss" in name only. They are wound with a poor grade of wire, often with defective insulation, and with metal braces in the wrong place. The various forms of basket-weave coils have attained a considerable degree of popularity lately, but you can bank on it that the product of any of the reliable manufacturers will bring in the signals *provided* the other parts in the receiver are right.



How Not to Build Your Receiving Set

The receiver pictured above is a typical example of what not to do if you want your set to be of "low loss" design—one that will bring in signals as clearly and as loudly as possible. Notice that the tuning coils are placed at one end of the panel and the tuning condenser at the other, with two-stage amplifier between them. While this arrangement looks well from the front, the long leads in the secondary circuit produce distortion

AND this is a very important point. You can take a really "low-loss" condenser, a correctly designed tuning unit, and sufficiently high grade parts to build a receiver, and yet if you place the parts in the set in the wrong position with relation to each other, you will lose all the value of the "low-loss" construction in the individual units.

In the first place, do not build a receiver in which the tuning coils are so placed that any large mass of metal is near the open ends of the coil. If you place a good "low-loss" coil against the condenser plates, for instance, it will have far higher losses than the worst coil properly placed. An audio-frequency transformer produces an effect that is even worse than condenser plates when placed in the field of the coil.

If you want to know what metal does when placed in the field of a tuning coil, just hold a tobacco tin flat against the end of the coil when the set is in operation and see what happens to the signals!

AFTER all, a "low-loss" receiving set is one that brings in the signals as clearly and loudly as possible. To gain the advantages that are inherent in "low-loss" parts, the amateur builder should be willing to sacrifice appearance to have the instruments placed most efficiently.

Perhaps one of the worst examples of poor design is the practice of arranging the tuning coils at one end of the panel and the tuning condenser at the other, with a two-stage amplifier located in between. Such an arrangement looks well from the front, but what can be said of the long leads in the secondary circuit? Distortion is almost sure to occur because of the capacity effect between the long connection with the grid of the detector tube and the audio-frequency wires, which often parallel it for many inches.

How Quickly Your Bureau of Standards to Test Your

It takes the average driver half a second to jam on the brakes after an emergency has presented itself. During this mental delay the car travels many feet. How quickly do you act in a crisis?

By Robert E. Martin

YOU are driving along at, say, 30 miles an hour. A shriek from a siren! A fire-truck darts out from a side street!

How fast do you apply your brakes?

"Instantly," you answer. You are wrong.

The Bureau of Standards, investigating the "mental slack" of motorists, finds there is an interval of almost half a second between the time an emergency calls for brake action and the time most of us actually apply the brakes.

In this half-second your car can travel 22 feet!

SUPPOSE you are driving an automobile at 30 miles an hour. Apparently the road is clear, when suddenly a siren shrieks and a fire-truck thunders from a side street directly into your path.

How quickly can you stop?

If your car is equipped with four-wheel brakes in perfect condition, you probably can bring your machine to a standstill within about 38 feet. And you will be borne out in this, apparently, by recognized charts of braking performance. But actually, can you? You may know that your car's braking mechanism will respond instantly to your foot on the pedal. But what about the speed of your mental machinery? How quickly, after your mind senses an emergency, can you jam on the brakes?

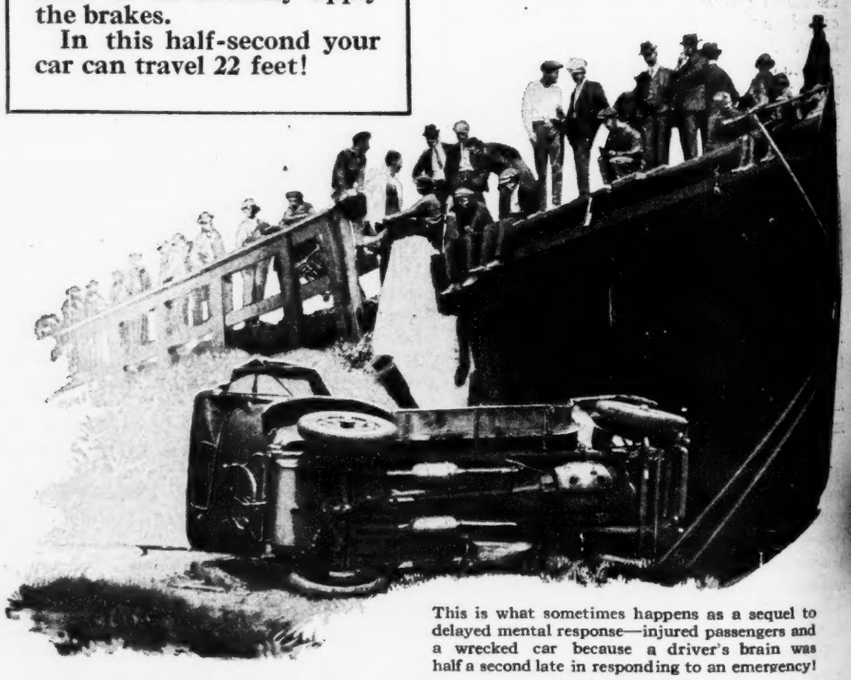
The answer to this question, as the result of recent discoveries by the U. S. Bureau of Standards, suddenly is revealed as a factor of tremendous importance in the appalling toll of death and injury from traffic accidents. For these discoveries, made with ingenious new measuring instruments, have demonstrated the surprising fact that for the average driver an interval of at least half a second elapses from the time he senses a warning of danger until he can jam on the brakes. And in this half-second interval of delay a car speeding at 30 miles an hour will travel a distance of 22 feet *before* the brakes are applied!

IN OTHER words, instead of being able to stop your car with four-wheel brakes within a distance of 38 feet, as you believe, the distance actually will be nearly 60 feet, if you are an average driver. And if you are below the average in quickness of mental response, the distance will be even greater.

These amazing new measurements of the mental slack in relation to safety on the road are more than substantiated in American traffic courts, where, every day, comes tragic evidence of the mental paralysis with which motorists are afflicted in the face of emergencies. There collisions and wrecked lamp-posts pass in constant review before the judge on the bench. There the drivers of automobiles appear at their worst—drivers whose mental alertness has been put to the test and has been found wanting.

A BALTIMORE judge recently told me of a man who was driving his car with the stream in a crowded street. A movement of cross traffic had just ceased, and the motorist moved ahead with his mind settled upon the idea that for several blocks he would enjoy uninterrupted progress before he would be stopped by the next intersecting stream of traffic. Normally this state of mind would have led him into no difficulties. But in this particular case, he encountered the unexpected in the form of fire apparatus speeding directly across his path.

There was no failure of signals and no lack of warning—a fact that was shown by the circumstance that all the cars behind this man came to an immediate stop. He was the one driver who failed. Not until he was within striking distance of a fire-engine did he attempt to apply his brakes. By this time, of course, his efforts were useless, and a bad smash resulted. Slow thinking cost the man severe injuries, a seven-passenger car, and traffic-court discipline. And there was nothing wrong with his brakes.



This is what sometimes happens as a sequel to delayed mental response—injured passengers and a wrecked car because a driver's brain was half a second late in responding to an emergency!

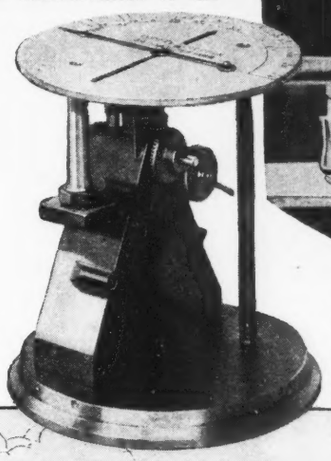
Can You Stop Car?

Devises New Ways Mental Speed

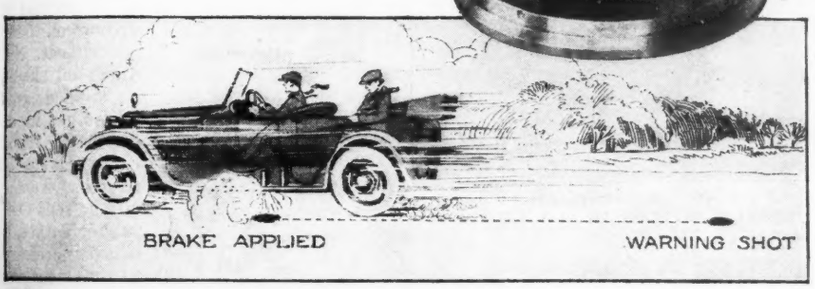
Just how slowly his mind responded was clearly established by the distance between the point of collision and the spot at which full stop was reached by the car immediately behind his own. This interval of clear space measured 36 feet, proving that he had ample time to apply his brakes and halt his car if his mind had not remained frozen. His sole explanation, in court, was that he had expected a clear channel and had not "taken in" the peremptory warning of the approach of the fire apparatus.

Incidents such as this might be cited without number. Again and again a valuable fraction of a second lost while the slack mind is registering an impression is sufficient to carry a car to disaster that might have been averted. Meanwhile the automobile death list grows, from more than 16,000 in 1923 to more than 18,000 in 1924.

The research of psychologists has shown that mental slack is as definite as the sag in a towrope or in the couplings of a freight train. In each case there is lost motion. The captain of a tugboat knows, from experience, how far he must travel before the sag of his line is taken up. Likewise, the locomotive engineer, from his cab, can judge with equal accuracy when his train is pulling smoothly. Now science has applied actual measurement to the time required to take up the slack in human thought processes. In the Bureau of Standards tests, government scientists are making available to every motor-car driver valuable new measurements that will give him more intelligent control over his car and assure him greater safety.



An official of the U. S. Bureau of Standards making a brake test with the decelerometer, a new instrument that measures the time required to stop a car. At the left is a close-up of the instrument, without its case



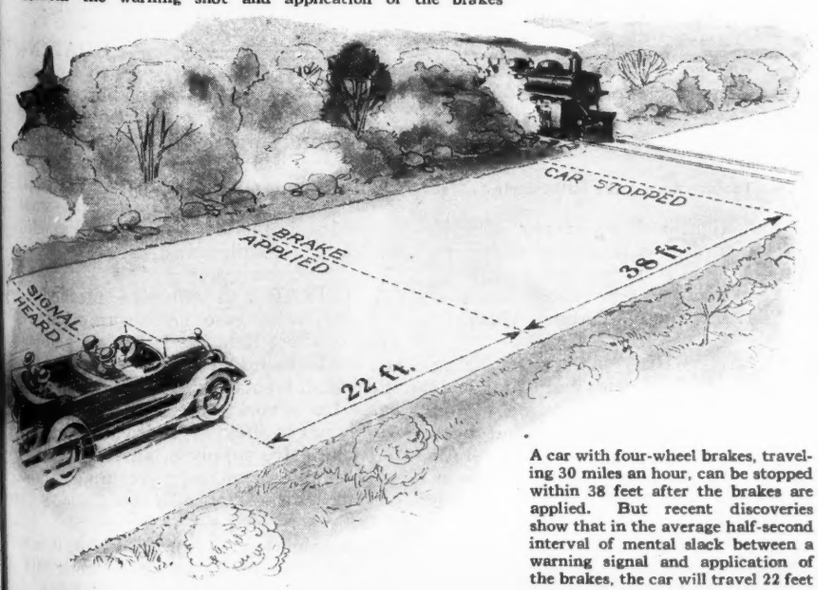
The pistol test of mental delay. Bullets of red lead mark the roadway, providing a means of measuring the distance traveled between the warning shot and application of the brakes

The apparatus used in the tests employs two pistol shots fired from a moving automobile. The first pistol is fired by a judge or inspector riding behind the driver. It represents a danger signal—a peremptory command to apply the brakes. In response, the driver jams on the brakes as quickly as he can, and the pressure of his foot on the brake pedal automatically fires the second pistol.

Each bullet, fired downward from the car, is made of litharge, or red lead, which produces a red mark on the roadway. The two splotches of litharge tell the story of the driver's mental alertness or laxity, for the distance between them represents the travel of the car during the time he spent thinking about applying the brakes and in moving his foot to the pedal. In addition, the time required to bring the car to a stop and the rate of slowing down are measured by a recording decelerometer, an ingenious instrument designed especially for the purpose by engineers of the bureau.

In the Washington tests the quickest time for any driver was a quarter of a second, the slowest was six-tenths of a second, and the average was close to half a second. The best showing was hardly to be counted, for the reason that the driver had his foot on the brake pedal at the firing of the first shot. In all the other

(Continued on page 147)



A car with four-wheel brakes, traveling 30 miles an hour, can be stopped within 38 feet after the brakes are applied. But recent discoveries show that in the average half-second interval of mental slack between a warning signal and application of the brakes, the car will travel 22 feet

Shortcuts for Car-Owners

Simple Light Holder

WHEN working on your car at night, you often wish you had an extra hand to hold your pocket flashlight. With the little device shown in Fig. 1 the lamp may be clamped on your head so that the beam of light is kept automatically on the spot where you are working. The flashlight is held in a clip made from strong wire fastened with four rivets to a small piece of sole leather. This in turn is riveted to a skate strap. When some inaccessible spot is to be reached with a screwdriver, the lamp may be strapped on the wrist.—F. S. ROOT, Fall River, Mass.

Fig. 1—Strap and wire clip hold flashlight in best position for illuminating the work

ALTHOUGH spindle-body bushings frequently need replacement, the removal of the old bushings often prevents the job from being done in the home garage. One car-owner, however, makes use of the method illustrated in Fig. 2. A saw cut about 1½ in. deep is made in an old spindle bolt, which then is inserted in one end of the spindle body and pushed to the lower end of the opposite bushing. The head of the bolt is placed on an anvil, and a small chisel or wedge is driven into the saw cut so that the spread end will engage the end of the bushing. A few hammer blows on the bolt head removes the bushing. The opposite bushing is removed in the same way and new bushings are driven into place and filed off to fit the yoke.—HAROLD N. WHITMORE.

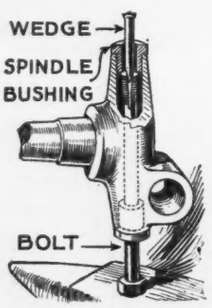


Fig. 2—Removing spindle bushings

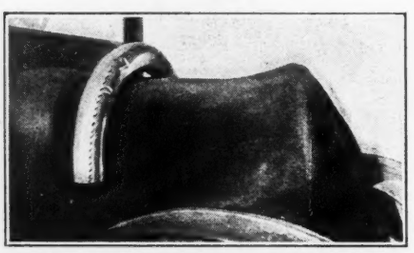


Fig. 3—Old tire prevents radiator blanket from being blown off in a high wind

Fig. 5—Folding pitcher

MECHANICS who park their cars outside a factory or building under construction from morning till night often find that a blanket thrown over the engine hood has been blown partly or entirely off and the engine has been chilled nearly to the freezing point. As appearances usually do not matter, it is a simple thing to use an old tire, as shown in Fig. 3; to hold the blanket over the engine. At night the tire section can be thrown into a corner of the yard for use on the next cold morning.—L. B. ROBBINS, Harwich, Mass.

ON ONE occasion when my regular tube repair kit was not large enough to repair a long blowout, I laid the tube on a piece of strap iron, placed my cement and repair rubber in position, covered it with wax paper, put a piece of tin over the hole and tightened down my clamps. Then I saturated a length of sash cord in gasoline, laid it on top and lit it (Fig. 4). This made a serviceable repair.—OSCAR M. ANDERSON, Tacoma, Wash.

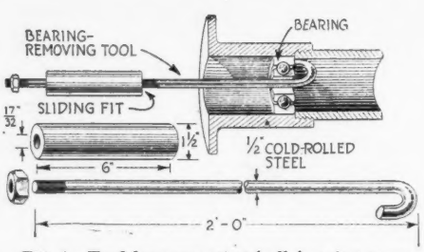


Fig. 6—Tool for extracting ball-bearing races

A COLLAPSIBLE pitcher for filling automobile radiators can be made as shown in Fig. 5 from a section of old inner tube fastened with shellac and tacks to a wooden top and bottom. Both should be an inch or more in diameter than the tube so that the rubber will have to be stretched over them. This pitcher takes up little room in the toolbox, but is exceedingly handy in an emergency when the radiator requires filling on the road.

Speeds Night Repairs

THE auto repairman often is confronted with the problem of extracting ball races or bearings that are located inside housings and cannot be driven from the opposite side. When such parts are only a light driven fit, they can be quickly removed by the use of the tool illustrated in Fig. 6. The hook is placed behind the part to be pulled out and the sliding handle is used as a hammer.

IN AN emergency it is sometimes valuable for the owner of a Ford car to know that the nut that holds the front spring perch on the front axle will interchange with the nut holding the rear wheel on either of the rear axles. If one of the rear axle nuts becomes stripped, it will not hold the wheel. By shifting the nut from the spring perch to the rear axle, however, and placing the damaged nut on the spring perch, the car still can be used. Cotter-pins are inserted in both nuts and if the spring perch does not seem secure, it can be wired temporarily.—G. A. L.

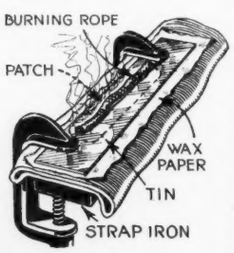


Fig. 4—Making a long tube patch

WHEN the plunger of a tire valve is no longer airtight, an emergency repair often can be made by removing the plunger and applying a drop of oil to the gasket seat. Not much oil should be applied, as it might get inside the tube and cause the rubber to rot. As the oil softens the rubber gasket, it will be necessary to replace the inside of the valve at the first opportunity.

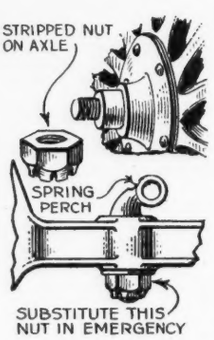
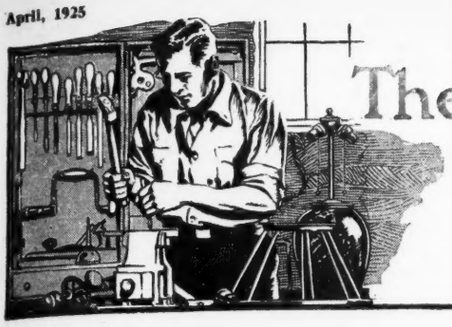


Fig. 7—Nut for axle

A COATING to protect the battery compartment and the surrounding surfaces may be made of equal parts of wood tar and resin melted together and applied with a brush while warm.

A CHEAP and effective method to economize gasoline consumption in a Ford or other light car is to drill and tap the intake manifold with a 7/8-in. pipe tap and install a small whistle valve. Such a valve has a spring to keep it closed. A wire is run to the dash so it can be opened to let an extra supply of air in, especially when running smoothly over a good road on long trips.—JAMES ELLIS.

AFTER soldering an auto radiator, it is a good plan to cover the new work with banana oil or shellac to close air holes.



The Home Workshop

Arthur Wakeling, Editor

Giving Wings to Your Speedster

How to Improve the Racing Quality of a Light Sport Car

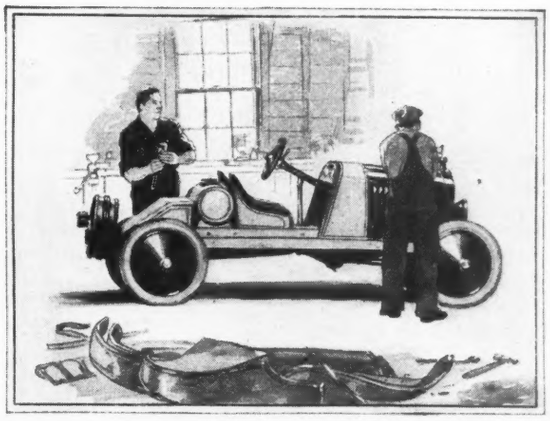
By George Arthur Luers

Automotive and Mechanical Engineer

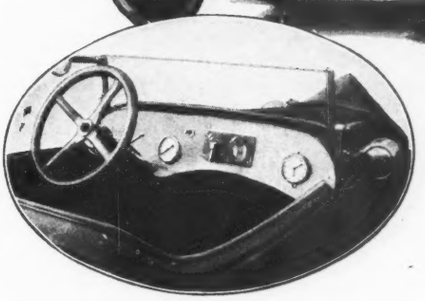
CONVERTING a Ford or other light car into a sporty-looking speedster is one of the most fascinating tasks undertaken in the home workshop. How many thousands of speedsters are built each year cannot be estimated, but their construction comprises the greater proportion of really elaborate projects undertaken by amateur mechanics.

So far as appearance is concerned, success usually rewards the builder of a sport car. A racy, ready-made body can be purchased, as well as wire or disk wheels and the various accessories that insure constructing a good-looking sport car. The difficulty often is, however, that the car's road performance does not live up to its looks.

How to add speed to your speedster is the real problem when building a sport car. It also is the most interesting problem. Whether you already have constructed a speedster or are planning to build one, it will pay you to make use of as many as possible of the following suggestions in remodeling the engine.



Properly remodeled, a cheap, light auto can be made fast and dependable on the road as well as distinctive in appearance like the sport car illustrated. Note the aluminum instrument board



On a fast highway you can hope to outdistance other cars only when engine conditions are just right. To get the necessary increase in engine revolutions, the engine balance, ignition, lubrication, cooling system, and all other factors must be designed and adjusted properly.

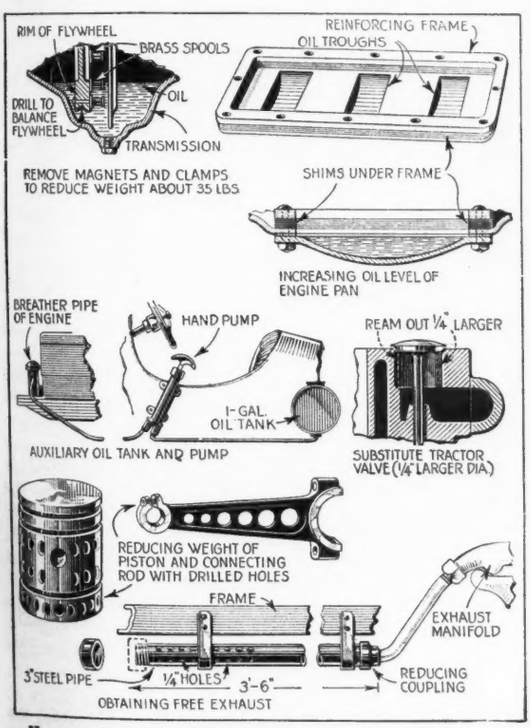
About 75 per cent of speedsters are remodeled Fords. Since a Ford has four separate coils operated from a low-tension magneto, each coil emits a series of sparks for each explosion in the cylinder. It is apparent that after the first spark ignites the explosion, the successive sparks are of no use. While this system is satisfactory for slow and moderate speeds, it will be seen at once that a multiplicity of sparking is not sufficiently accurate when the engine is turning over at 2000 or more revolutions a minute.

A speedster normally is fitted with a starting and lighting battery. This leads to the use of a single spark system of ignition, which gives a single hot, live spark for each explosion. Such a spark can be timed accurately to occur at the correct point in the compression and it acts uniformly for each period of engine rotation.

Equally good results are to be obtained with a high-tension magneto. A magneto of this type, with complete fittings, can be had for attaching to the timing gear in the front end of the motor or to the end of the camshaft after the regular roller commutator assembly has been removed.

The low-tension magneto should be removed unless the coils are used for lighting purposes, when no battery is pro-

(*Continued on page 120*)



How to reduce the weight of engine parts, enlarge the valves, improve the lubricating system, and reconstruct the muffler

Where to Find This Month's Mechanical Features

The Home Workshop
Pages 83 to 123

The Shipshape Home
Pages 124 and 125

Better Shop Methods Department
Pages 88 and 126 to 136

A Folding Screen for the Nursery

Has light panels of enameled wallboard ornamented with rabbits

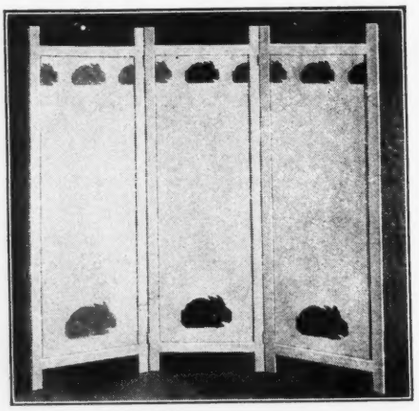
By A. Neely Hall
Specialist on Handicrafts in the Home

A SCREEN is useful in the bedroom for several purposes, among which may be mentioned the shielding of the bed from draft from an open window and from glare of morning sunlight. It is an essential part of nursery furnishings, yet often is one of the last things provided because of the cost. To the father handy with tools, making a screen is no trick at all.

The framework of the threefold nursery screen in the photograph is of 1 by 2 in. strips, which can be purchased at any lumber yard. The panels are of wallboard, obtainable from the same source. Wallboard serves well for paneling, and is easier to obtain in wide pieces than wood, which usually must be veneered if wider than 12 inches. It is more desirable for nursery use than any textile because it can be enameled and thus made washable and sanitary.

Number 1 of the mechanical drawings gives dimensions for the framework of the screen, and 2 and 3, details of the stiles and rails. Note that the strips are grooved to receive the edges of the panels; also, that they are mortised and tenoned. If you have no dado plane with which to make grooves, use a ¼-in. chisel. It is easy to cut them. Make the grooves at least ⅜ in. deep.

Coat the edges of the panels, the grooves, mortises, and tenons with glue, and after assembling, reinforce the glued joints with finishing nails.



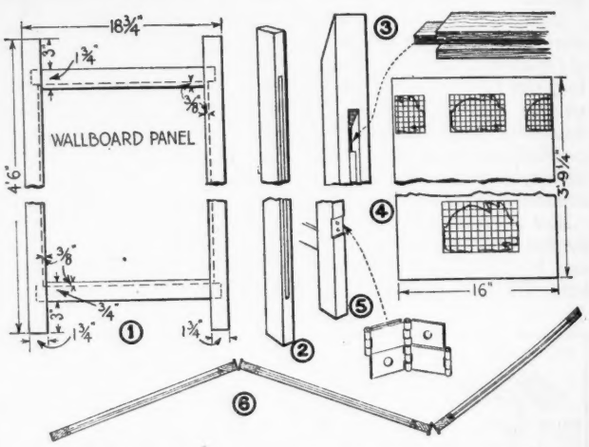
A screen that is easy to keep clean

Ordinary hinges may be used for hinging the frames of the screen, but they fold only one way. A better hinge is the double-acting type shown in 5 and 6. Notch the edges of the stiles to admit the flaps of the hinges.

After fitting the hinges, remove them until you have finished the frames. Two coats of flat white and one or more coats of white enamel should be applied.

A child's screen is more interesting if decorated with nursery figures, and it is easy to apply these. You will find suitable pictures in nursery books and magazines, and you can enlarge a picture to the size desired by the system of squares, as explained by the sketches of a rabbit in the panel diagram.

First, make a paper tracing of the picture selected, and draw parallel and vertical lines across it, spacing the lines at equal distances. Make a set of similar but larger squares upon a piece of cardboard, draw the outline of the picture upon the large squares as it is seen upon the small squares, and the enlargement will be an exact reproduction of the small drawing. Cut along the outline of the larger drawing, and use this cardboard pattern to draw around in laying out the picture upon the panel. With the picture or pictures drawn in lead-pencil, fill in between the lines with black paint. Black auto enamel is excellent for the purpose.



How the framework is put together, with mortise and tenon joints. Details of the wallboard panels, and a double-acting screen hinge

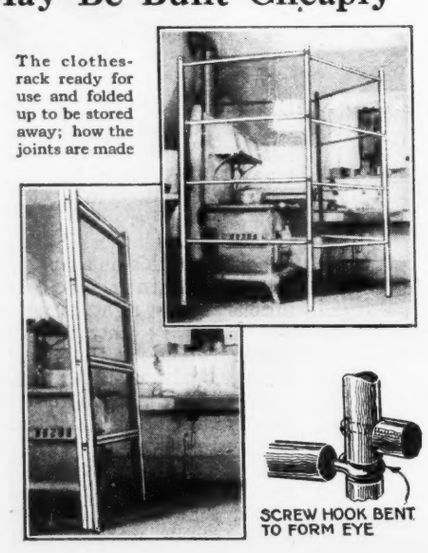
Large Clothes-Rack May Be Built Cheaply

TO INSURE quick drying, a clothes-rack must be designed to allow the air to circulate freely around the clothes. The rack illustrated is large enough to insure this and at the same time it is so built that it can be placed around the stove, hot-air register, or radiator. If only a few clothes are to be dried, it need not be unfolded fully. When not in use it collapses flat.

In building one section of the rack, fasten one end of each horizontal bar or strip to one of the uprights with long, round-head wood screws. The other upright is grooved at corresponding intervals so that screw hooks turned into the ends of the horizontal members may be placed in the grooves and bent to form a sort of screweye fastening. These screweyes are loose enough to act as hinges.

As many sections as desired may be built and connected, as shown in the accompanying photographs.—J. J. BYBERG.

The clothes-rack ready for use and folded up to be stored away; how the joints are made



SCREW HOOK BENT TO FORM EYE

Pump Repaired with Rubber

FARMERS and others who depend on a well for their water supply often have considerable trouble because their pumps "run down" and have to be primed every time water is wanted. This trouble usually can be remedied at practically no cost other than taking the pump apart.

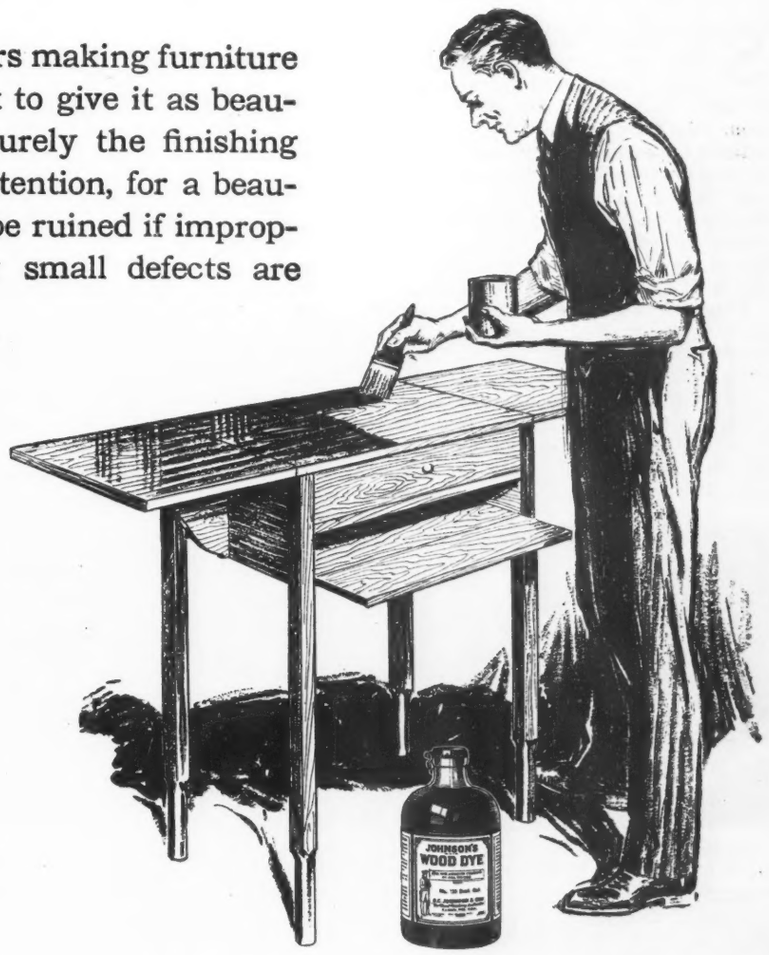
From a piece of old inner tube or patching stock, cut a piece the same size and shape as the flap on the lower leather check valve. Attach the rubber to the under side of the valve flap with the bolt or screw that holds the iron valve weight. Be sure the rubber is as large as the flap. Then put the pump back.

The rubber is more flexible than the leather, and sand will not get under it and collect on it. While this is a simple repair, it is surprising how well it works. Our pump gave us trouble for years at various times, but this repair ended the difficulty.—CLYDE BRINDEL.

How to Give Home-Made Furniture that Finished "Professional" Look

After spending precious hours making furniture by hand, you naturally want to give it as beautiful a finish as possible. Surely the finishing should receive its share of attention, for a beautiful piece of furniture may be ruined if improperly finished, whereas any small defects are minimized if well finished.

The Johnson Book on Wood Finishing gives complete instructions for finishing new and refinishing old wood—soft or hard. It tells how to stain wood artistically—how to remove old paint and varnish—how to secure a beautiful enamel finish, etc. This book is the work of experts—profusely illustrated in color. It includes color charts—gives covering capacities, etc. It is full of valuable, authoritative information on Artistic Wood Finishing. The coupon below tells how to get a **FREE** copy of this authoritative manual on a fascinating subject.



JOHNSON'S WOOD DYE

Johnson's Wood Dye is for the artistic coloring of all wood. It is very easy to apply—dries in four hours and will not rub off or smudge—penetrates deeply, bringing out the beauty of the grain.

Johnson's Wood Dye is a *dye* in every sense of the word. It contains no finish whatsoever. Like most first class products it answers one purpose only—it *dyes* the wood. A finish must be applied over it—we recommend Johnson's Varnishes or Johnson's Polishing Wax.

Johnson's Wood Dye is made in seventeen beautiful shades, among the most popular of which are:

123—Dark Oak	*131—Walnut*
129—Dark Mahogany	*126—Light Oak*
127—Brown Mahogany	*124—Golden Oak*

All shades may be easily lightened, darkened or intermixed. Full directions on every label. Select the shade of Johnson's Wood Dye that you want and order it from your dealer by name and number.

FREE—25c BOOK ON WOOD FINISHING

Ask for a **FREE** copy of the Johnson 25c Book on Wood Finishing at stores displaying the sign shown at right. These stores carry Johnson's Artistic Wood Finishes and will be glad to show you wood panels—and answer questions on how to properly finish wood. If no store in your locality can supply the Johnson Book—mail this coupon for a copy—Free and Postpaid.

YOUR DEALER'S NAME .....

Your Name .....

Your Address .....

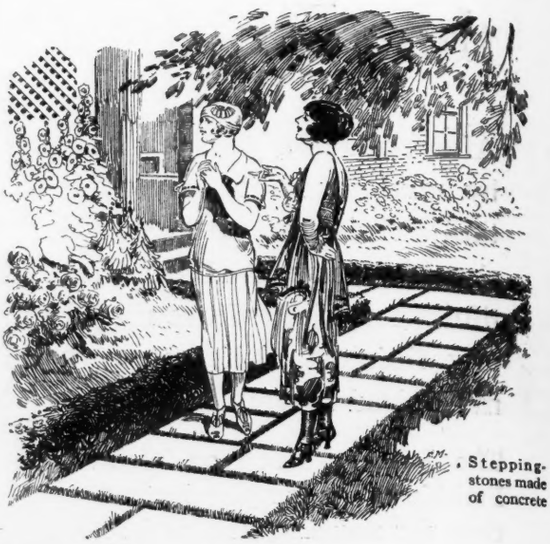
City and State .....

S. C. JOHNSON & SON, Dept. P.S.4, RACINE, WIS.

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

Stepping-Stones for Garden Walks

How you can build picturesque pathways about your home



Stepping-stones made of concrete

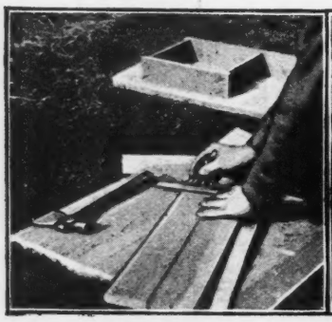
STEPPING-STONES made of concrete are much less expensive and much easier for the home-owner to make than a solid sidewalk. In addition, they have the advantage of a more artistic appearance for garden pathways or walks between house and garage. The fact that so many architects now specify stepping-stone walks in connection with designs for costly residences is an indication of their decorative value and growing popularity.

Frost will not injure this kind of a walk, for if the individual stones are lifted in the winter, they will settle back in place when spring comes.

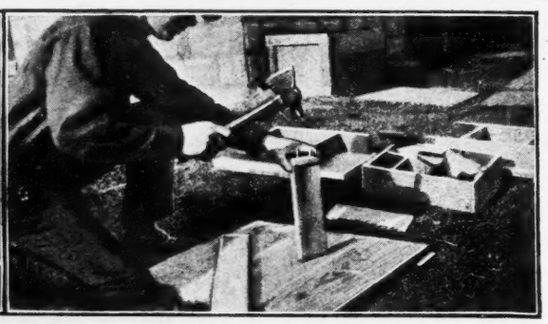
Slabs of several sizes make a more attractive walk than if only one size is used. In the walk illustrated a pleasing pattern has been obtained with only three different sizes of slabs. The sizes used are: 9 by 9 in., 9 by 11 in., and 11 by 22 in. These three sizes can be arranged in a large variety of combinations, with about 2 in. of sod between them.

One form for each size is sufficient to produce a considerable length of walk in the course of a few days, but if more speed is desired, two or more of each may be used.

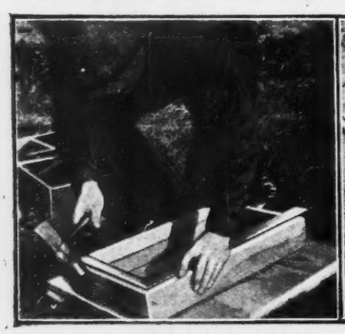
The forms are made from pine lumber about 3 in. wide, nailed to any sort of boards, or simply nailed together and laid on smooth ground. If the forms are laid on the ground, care must be taken to keep the framework down by driving pegs into the earth and nailing the wood to them.



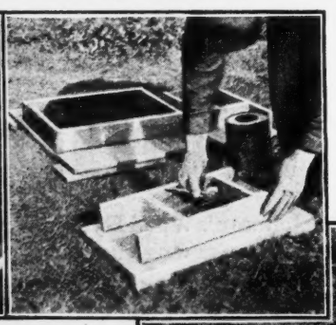
Marking length of form members which are made of 3-in.-wide strips



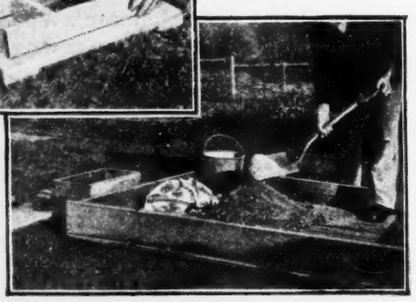
In nailing the forms together let nails project so they can be pulled out easily when the concrete is hard



Square the form and nail it to a baseboard



Oil the forms lightly with brush or rag to prevent cement from sticking. Discarded crankcase oil may be used for this purpose, if desired



Mix the cement and gravel thoroughly before adding water, then wet the mixture and turn it over and over until uniform in consistency. This mixing-board is the back piece of a piano box

The correct consistency of the concrete is shown above. Avoid a sloppy mixture. After the forms are filled, the surface is smoothed with a wooden block, as at the left. A very smooth surface is not desirable, so do not do too much troweling

The mixture to be used for the lower part of the slabs can be one part of cement to four parts of coarse, clean gravel. Remember to mix the gravel and the cement thoroughly before adding water, and add the water in small amounts, being careful not to produce too wet a mixture.

Now oil the forms and fill them to within ½ or ¼ in. of the edge with the mixture. "Tamp" it down solid and run a trowel around the edges to force the larger pieces of gravel away from the boards.

The work is now ready for the finishing coat, which is made up of two parts fine sand and one part cement. This mixture may be colored to suit the maker's taste and design by the use of Venetian red, burned umber, yellow ochre, or almost any other inexpensive color, in powdered form. This color should be mixed dry with the cement and sand before water is added. Too much color will weaken the cement.

When the surface has been smoothed with a wooden block, the sharp edges around the form can be rounded with a sidewalk edger, with a small trowel, or, in fact, with a homemade wooden tool.

The slabs are left for one or two days until the mixture "sets." They must be protected from the sun during this process and should be kept moist, particularly if the weather is hot. The forms are used again and again until a sufficient number of stones is made.

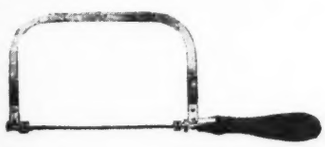
When enough slabs have been made for the walk, a sketch should be made showing the best arrangement of their positions. The simplest way to lay them is to excavate as for a continuous walk of the same width and, after the slabs are laid, put pieces of sod between the blocks.

More irregularly shaped stepping-stones can be made without forms simply by excavating holes in the ground and filling them with concrete.

To the million young men who are buying their first saws

Whatever work you have to do, there is a Disston Saw to do it

Disston Back Saw, No. 4—For accurate cutting of mitres, fine joints, or stock of small dimensions.



Disston Coping Saw, No. 10—For cutting scroll work, ornamental wood work, toys, etc. Tension of blade adjustable to each job.

Disston Nest of Saws, No. 3—Ten-inch key-hole saw, 14-inch compass saw, and 16-inch utility or pruning saw, with adjustable handle.

YOUR first saw! When you choose it, you are setting a standard for the work you have to do in all the years to come.

You need not be an expert when you go to buy your saw, for the carpenter has chosen for you.

The Disston Saw, everywhere, is "The Saw Most Carpenters Use."

The Disston Hand Saw cuts true to the line. It is true itself—smithed and tensioned on the anvil by a master of the craft.

It cuts fast without binding because it is ground right for clearance. Only a Disston craftsman can taper a saw blade to work like that.

It seems "alive" when you use it, so easy is its balance. Only a Disston expert can give a saw such balance.

And your Disston Saw will hold its edge: Disston makes the steel and gives it the Disston temper!

Disston Saws, of Disston Steel, are the most widely used saws in the world. Mechanics everywhere have learned what the name Disston on a saw means to them.

"After 20 years' use, my four Disston Saws are good for another 10 or 20 years. Some saws! The good old Disston—an honest saw for honest work."
—*John J. Harris, Brattleboro, Vt.*

"I am still using a Disston Saw that was my father's before me. It has been in use 65 years and is still good. I have used Disston Saws for 36 years."
—*J. E. Harrison, Atlanta, Ga.*

"I wouldn't lay down my Disstons for any other saws on earth, and I have been using them for more than forty years."
—*L. L. Loftis, Price, Utah.*

You will find the Disston Hand Saw at the nearest hardware store.

Take it in your hand. Try its spring, its easy thrust and balance. Then make that saw your own!

Ask Disston!

Tell us what kind of work you are doing, in wood, metal, stone, ivory, rubber, leather, cloth, fibre or other material, and we will tell you what types of saws to use. Disston issues many books to aid the users of saws and tools.

Henry Disston & Sons, Inc.
Philadelphia

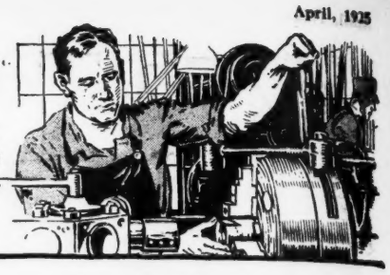
Hardware dealers the world around sell Disston Saws, Tools, and Files

DISSTON

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

Better Shop Methods

How Expert Mechanics Save Time and Labor



Cabinet Keeps Lathe Tools Handy

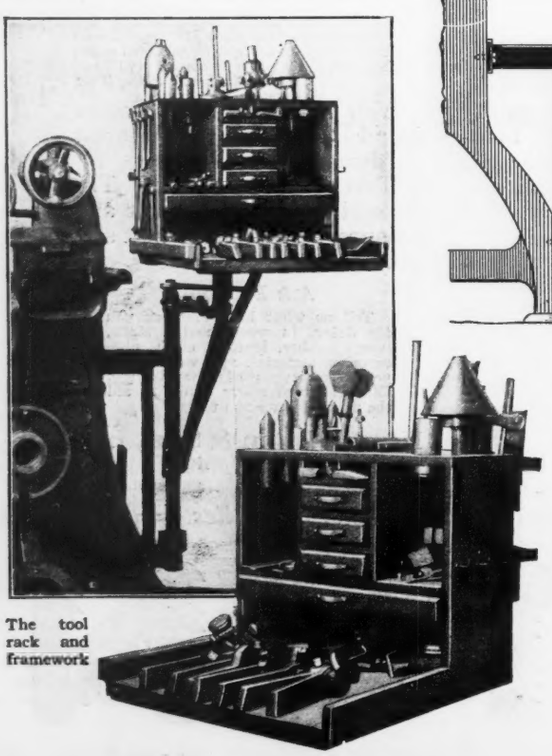
By Edward Kilburn
Machine-Shop Superintendent

NOTHING is more conducive to fast and accurate work than to have the proper tools within arm's reach. This is especially true in respect to lathe work, which plays such an important part in every machine-shop's output.

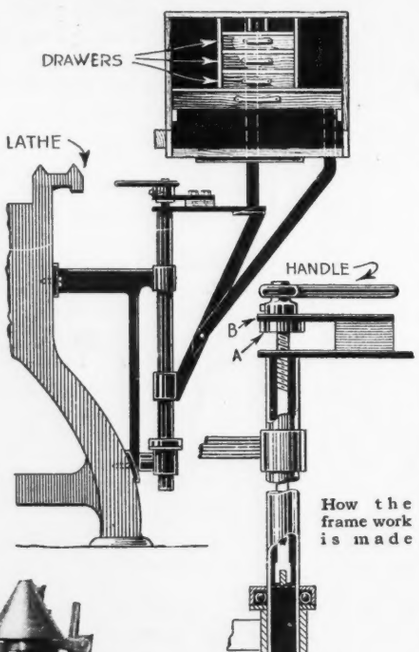
"A place for everything and everything in its place" is, indeed, a maxim particularly applicable to the machinist's trade. The great number of small tools and appliances cannot be used to best advantage of they are not handy.

The accompanying illustrations show how to provide facilities for properly taking care of all the small tools and accessories used in connection with lathe work. The rack is particularly useful where it often is necessary to remove the toolboard (if one is used) when doing full-length work on the lathe.

The tool cabinet is supported by a frame made of pipe, pipe fittings, and flat and angle steel plates, joined together by welding. The stationary portion of the frame is bolted to the back of the lathe-bed near the tailstock end. The other part is adapted to swing upon the stationary portion and carries at its upper end a cabinet with suitable drawers for cutters and other small parts. The lower flat or table portion of the cabinet is used for lathe tools; the upper board to hold lathe centers, tailstock chuck, and the like.



The tool rack and framework



How the frame work is made

The mechanism of the device is so arranged that when the cabinet is in position over the lathe-bed, it may be lowered to rest firmly on the bed. When it is desired to remove the cabinet from the bed, the cabinet is raised and swung around out of the way. A ball bearing is provided at the lower end of the frame to make its operation easy.

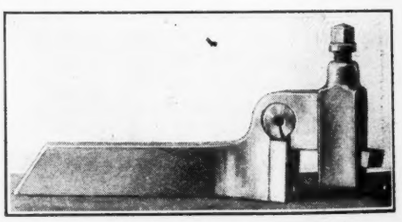
The mechanical diagram shows clearly the construction of the elevating device and bearing. It will be noticed that there is a central threaded rod. At its lower end this bears on a cross bar, which rests on the top of the ball bearing. The bar is located in a slot in the central hollow portion of the swinging frame. Screwing the nut *A* at the top of the bar against the upper flat bar *B* raises the frame and with it the cabinet. Releasing the nut lowers the cabinet.

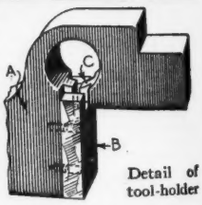
The nut *A* has a flange or enlarged lower portion, which bears upward against the bar *B*. The main or upper part of the nut, which passes through *B*, is fitted with a handle.

This device is much more convenient than a stationary cabinet, which must be removed to the floor when long work is placed in the lathe. As soon as it is on the floor, a cabinet becomes nothing more than a stumbling block for every passer-by, and the chances of tools being lost or damaged are greatly increased.

Spring Threading Tool

TO OVERCOME the shortcomings of certain commercial spring threading tools, which have no provision to prevent them from springing sideways or parallel with the axis of the screw being cut, the tool illustrated was devised. It is prevented from springing sideways by the plate, *B*, shown directly beneath the spring bushing. This is keyed and screwed to the shank, *A*, and has a slot in its top edge that engages a keylike extension or lug, *C*.





Detail of tool-holder

Bushings are inserted as desired, to increase or decrease the spring of the tool.—CHARLES KUGLER, Philadelphia, Pa.

DON'T fail to turn to pages 126-136, where you will find the continuation of the Better Shop Methods Department.

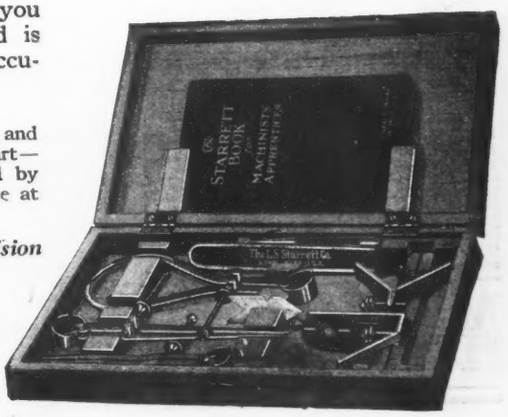
Why do the Crack Machinists Advise the Apprentice to start with Starrett Tools

Apprentice Set No. 901

You'll use the Starrett Tools you buy today for the rest of your life. Ten years seems like a reasonable length of service for a Precision Tool, yet any veteran machinist will show you Starrett Tools which he has used twice and three times ten years. It's all in the way Starrett Tools are made. Parts are correctly proportioned. The finest steel the market affords goes into these lifetime tools. The workmanship is unexcelled—a characteristic which is obvious when you examine a Starrett Tool—and is always evident in its lasting accuracy.

Starrett Apprentice Sets (Nos. 900 and 901) give you the tools you need to start—and tools you'll always need. Sold by first-class hardware stores everywhere at a price you can afford to pay.

Write for Starrett Catalog No. 23 "W" describing the uses of 2200 Fine Precision Tools FREE.



Ⓢ

THE L. S. STARRETT CO.

World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
Starrett Tapes—Standard for Accuracy

7550

ATHOL, Mass.

The Starrett Set for Apprentices and Students comprises the following Precision Tools neatly cased in a substantial and nicely finished wood tool box: 6-inch Combination Square No. 11 complete, 6-inch Flexible Steel Rule in Pocket Case No. 320, Center Punch No. 117-B, Center Gage No. 390, 5-inch Divider with Spring Nut No. 77, 6-inch Outside Caliper with Solid Nut No. 79, 6-inch Inside Caliper with Solid Nut No. 73. *And* the Starrett Book for Machinists' Apprentices (Vol. I), 184 pages that show "how to do it."

Ⓢ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

Look for
"D. MAYDOLE"
on the head

IT'S definite assurance that the hammer with the looks and perfect "hang" has in addition a quality and toughness that makes it good for years of hard service.

Most experienced tool users can tell a Maydole Hammer even without looking at the name. It has a distinctive character that has been developed and enhanced throughout the 82 years devoted by its makers to perfecting the hammer. Pick up a Maydole and you'll find it has a "hang" unlike any other hammer—most carpenters, machinists and other mechanics like it better.

Maydole Ball Pein Automobile Hammer
Head is of press-forged steel tempered separately at each end for the particular work it is to perform. Handle is of clear, second-growth hickory, air dried for years.

Ask your hardware dealer to show you a carpenter's, machinist's or other type of Maydole Hammer. You'll see the difference.

Write for useful pocket handbook 23 "B." It's free.

Maydole Hammers

ON YOUR HAMMER SINCE 1843

The David Maydole Hammer Co.
Norwich, New York

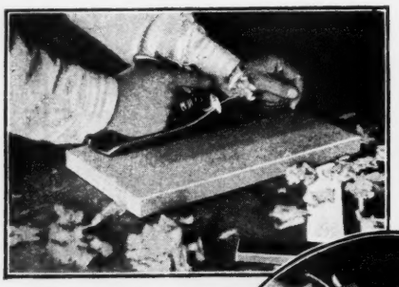
7050

The Home Workshop

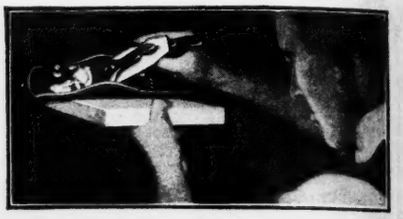
How to Plane a Board Accurately

Expert Shows You His Own Methods

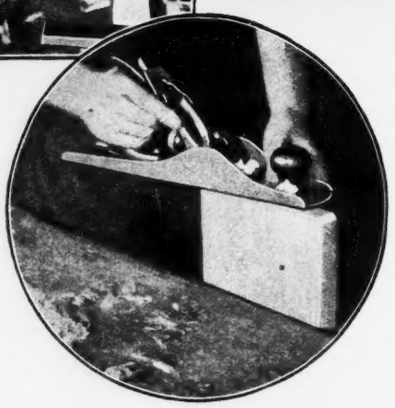
By **Emanuel E. Ericson**, *Noted Manual Training Authority*



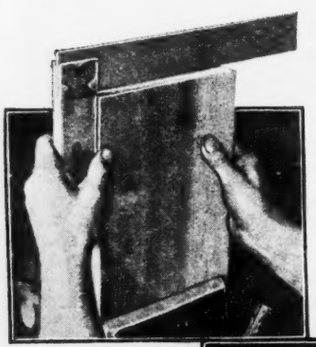
Surface planing with strokes made the whole length of the board, if possible (above). If board is wide, "cross plane" it first; then start at one edge, letting each shaving partly overlap the previous one until the whole surface is covered. Repeat, working back to the first edge



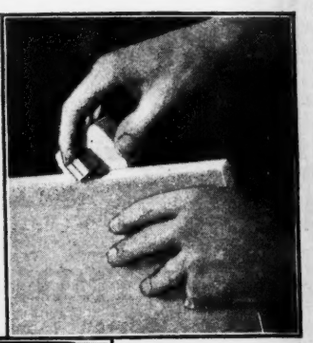
Testing the surface with edge of plane against the light (above). Also test from corner to corner to detect twist or "wind." If board is large, this is done on the bench, using a straight edge, if plane is not long enough



Planing end (at left) after one broad surface and one long edge have been planed. The long planed edge is toward the worker. Note that one corner is chiseled off to prevent wood from splitting



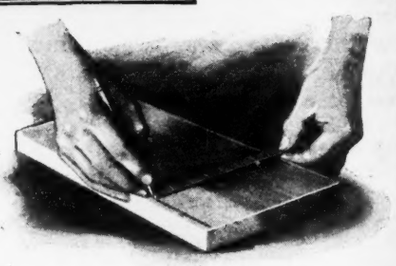
Testing with square (at left). The end must be tested both from the broad surface and the long edge. Hold handle firmly against surface and let square down slowly. The last plane stroke must be right across



Marking to length (at right). Lay rule on surface, locate knife at correct point, then move square up against knife. For accurate work, draw lines all around the board

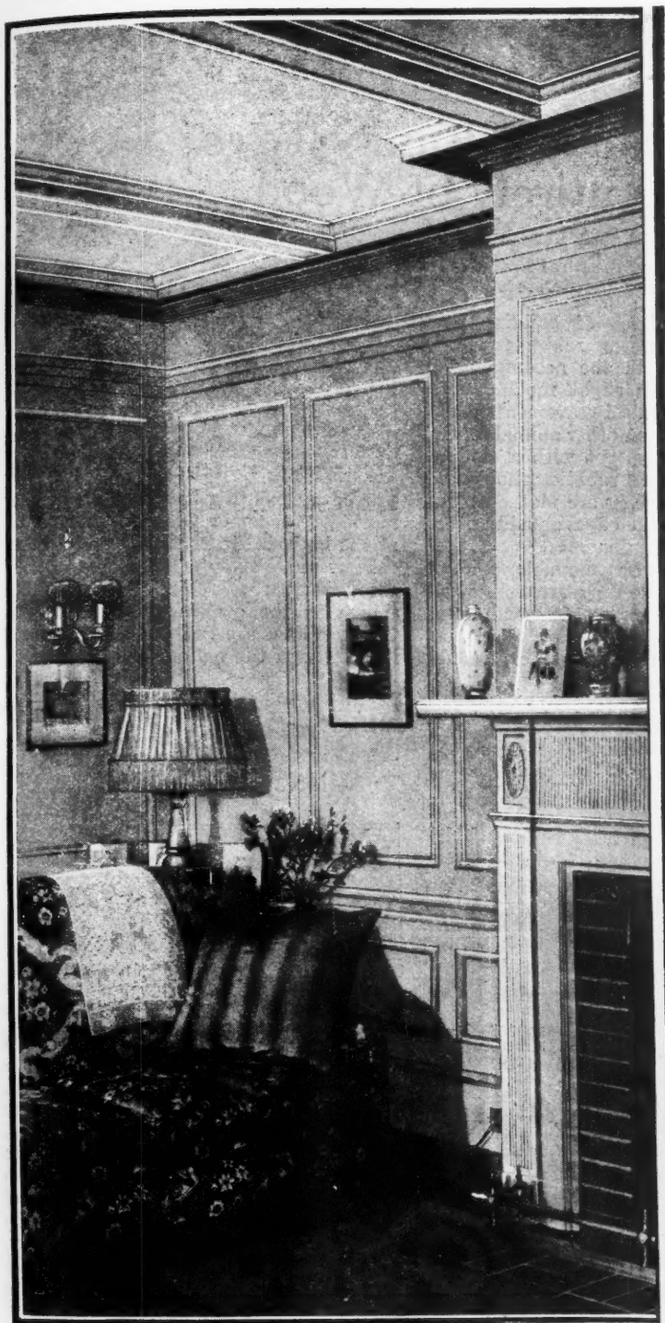
Gaging for thickness (above). Hold the gage firmly against the wood and tilt bar forward. Mark both ends and edges. When planing put rough end against the bench stop

Sawing board 1/16 in. beyond knife line to allow for truing the end with the plane by the method previously used



Marking to width when a board is too wide for the gage. When the edge is planed, the chiseled corners disappear

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.



At last-

a wall that successfully resists heat-cold jars-moisture-time

IN NINE out of ten homes, investigation shows at least one cracked, shabby plaster wall or ceiling!

Now there is a sure, quick, easy way to transform such a room. *Upsonize!* Apply big, sturdy panels of Upson Board right over the old plaster—in new construction, direct to studs. Then, appropriate wood trim, a coat or two of paint—and your room is finished.

Upson Self-Clinching Fasteners, a patented and exclusive Upson innovation, eliminate ugly nail marks—the big objection to ordinary wallboards—by anchoring Upson Board securely from the back.

The nearest-perfect wall material!

Conclusive tests have proved the superiority of Upson Board. In one of many dramatic tests for strength, made by impartial engineering laboratories, weights were dropped from several heights upon specimens of different wall materials. Upson Board withstood an impact of 40% to 70% more than the other fibre wallboards tested, and nearly 150% more than plaster-filled boards twice as thick. Jars and blows that would ruin ordinary plaster walls have little or no effect on Upson Board.

In another impressive test, Upson Board immersed in water for a given length of time gained only ½ ounce to the square foot. Gypsum-filled board exposed to the same test increased nearly ½ pound to the square foot. Other wallboards were found to absorb nearly twice as much water as Upson Board. The ordinary leak has little or no effect on Upson Board.

A wonderful new plan service!

Ask your lumber dealer to see the amazing new Upson Blue Book—the most complete plan service ever offered for renewing and beautifying walls and ceilings. If he hasn't it, send us his name and 25c, and we will mail you full-size blue print with complete directions for Upsonizing any room. (State kind of room and whether new construction or remodeling.)

THE UPSON COMPANY
427 Upson Point Lockport, N. Y.

UPSON PROCESSED BOARD

Genuine Upson Board has the famous Blue Center

UPSON PROCESSED BOARD

IN THE attractive living room above, Upson Board has permanently renewed shabby walls and ceilings.

And aside from its use for walls and ceilings, Upson Board has 100 uses around the home. Its easy workability makes it ideal for making wardrobes, photographic dark rooms, cabinets, doll houses, wastebaskets, lapboards, tables, toys and countless other useful articles.

It will pay you to keep a few panels in your home workshop. Mail the coupon for samples and details!

THE UPSON COMPANY
427 Upson Point, Lockport, N. Y.

☐ Check here and mail with 5c if you want Upson samples and literature.

☐ Check here and enclose 25c if you want blue print.
What kind of room?.....
New or remodeling?.....

NAME .....

ADDRESS.....

Ⓘ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

The Wheel's the thing

THE new Millers Falls glass cutter wheels cut as steel wheels never cut before. They are hard, sharp, uniform; the edges last. They are *right.*

We've been making glass cutters for 45 years. With all that experience, we put in more than a year of intensive plugging to develop our improved wheels.

The wheel has always been the weak spot. We tried many steel alloys, different heat treatments. Each new lot of wheels was tested rigorously.

Now we say they're right, because we have proved it to ourselves. The Millers Falls name on them proves our confidence to you.

This is No. 7 Improved— single wheel; easy grip handle, enameled red.

This is No. 300 Improved— six perfect wheels in turret flush with frame. Wheels protected from injury by patented feature of cutting arbor integral with turret. Easy grip handle, enameled hardwood.

Millers Falls Improved Glass Cutters

with the new long-life, fine-cutting wheels. Special alloy steel wheels; hardened by special process; uniform; lasting. They make a deep, clean cut. Eight styles.

MILLERS FALLS COMPANY
Millers Falls, Mass.

28 Warren St. New York — 9 So. Clinton St. Chicago

Manufacturers of Mechanics' Tools, Hack Saws and Automobile Tools

MILLERS FALLS TOOLS
SINCE 1868

The Home Workshop

Ingenious New Bunny Toys Made Entirely of Wood

By Charles M. Miller

Asst. Supervisor of Manual Training, Los Angeles City Schools

MANY methods of building new and interesting rabbit toys are suggested in the accompanying illustrations. With slight modifications some of the mechanical movements could be used effectively on other animal forms.

The edges of toys cut with a coping-saw, such as these rabbits, should be square. Whether they are filed or sandpapered, or both, the edges should not be rounded, as is often done.

The back legs, when movable, operate in unison. Usually they are connected below the body by means of a small dowel through both feet.

Among the many mechanical movements possible, that of the rabbit shown in the photograph is perhaps the simplest. The form is ½-in. thick wood. The front wheels are glued to a ¼-in. dowel that passes through a 5/16-in. hole in the front feet. Small button molds are slipped up close, but not too tightly, against the sides of the feet to prevent the axle from slipping from side to side. The rear axle is the same except that the wheels are larger, in this case 3 in. in diameter, and closer together. The rear wheels are fastened to the axle about ¾ in. off center; this gives a jumping motion (Fig. 1).

Peter Rabbit in this particular toy has a red coat with a black collar. The appearance of any rabbit toy can be improved by painting it with characteristic markings, some of which are suggested at the bottom of the page.

Four movements a little more complicated than the Peter Rabbit toy are shown in the drawings of Fig. 2. In the first one, the rabbit raises his front feet through the action of a cam on the rear axle, which pulls a string attached to the tail. At the same time another string, which runs from the baseboard up through the front of the body and the head to the ears, raises the ears at the end of the upward movement of the body.

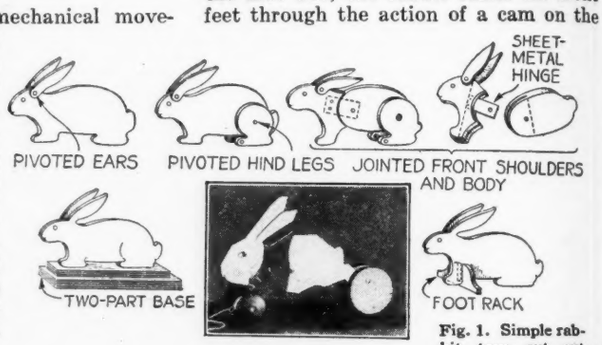


Fig. 1. Simple rabbit toys cut out with a coping-saw

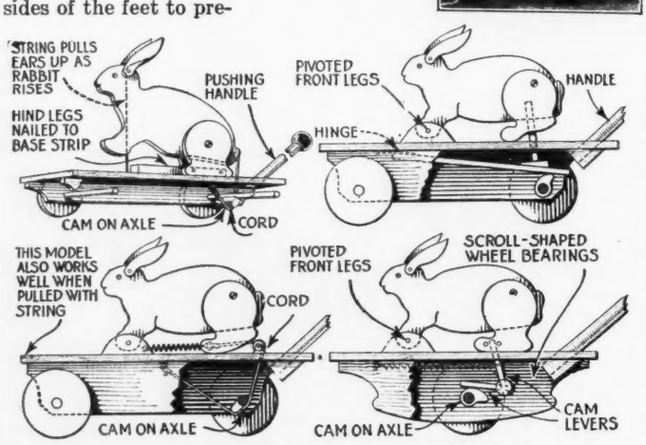


Fig. 2. Four methods of giving a toy bunny a lifelike hopping motion as it either is pushed by a handle or pulled along the sidewalk

Shown at the right of this is a method for making a bunny hop. A wooden cam glued on the rear axle moves up a hinged board that in turn pushes up the hind feet. A third method provides for raising the hind legs with a string and cam and pulling them back with a spring. This toy operates well when pulled; the others are more certain in their action when pushed. In the fourth example the cam's motion is transmitted through two levers mounted on a shaft.

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

Save Your Knuckles

GO OVER every bolt and nut, from motor to rear end, with an ever-useful set of Blackhawk "Q.D's." There's a socket to fit every job, without ever slipping off—and a handle to give you just the right reach and leverage.

Whatever make or model of car you drive, your dealer can supply you with a selected "Q.D." set—especially designed by Blackhawk engineering for your particular car.

Extra husky handles with comfortable grips and sturdy broached sockets—exactly 1/64″ oversize—tougher than any nut they will ever meet. You will like the rich, durable, all-black finish that's baked on.

See your dealer. Have him show how simple home repairing is with a Blackhawk "Q.D." set. If he can't supply you, write us direct.

Made and Guaranteed by

AMERICAN GRINDER MFG. CO.

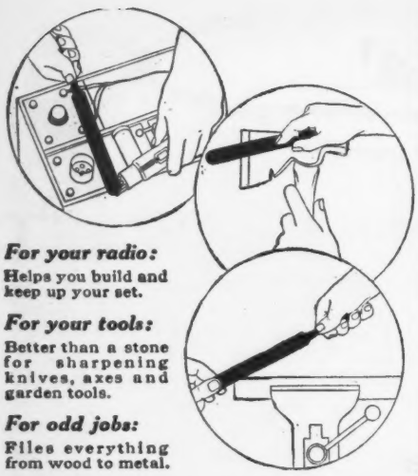
Dept. L, Milwaukee, Wis.

(Also manufacturers of Blackhawk Water Pumps for Fords)

When you see a "Hex" think of BLACKHAWK!

BLACKHAWK Welded Wrenches

Ⓢ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

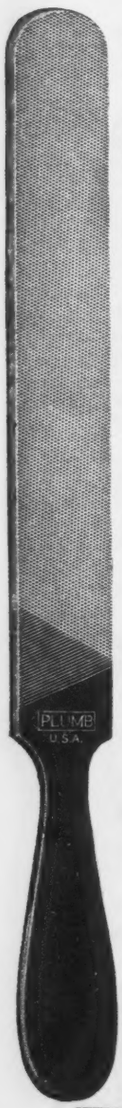


For your radio:
Helps you build and keep up your set.

For your tools:
Better than a stone for sharpening knives, axes and garden tools.

For odd jobs:
Files everything from wood to metal.

With this file you can do any job



ANY man who likes to work with tools needs this new and better file—The Plumb All-Work File.

The handle, forged as part of the file, fits your hand, gives you perfect control of the stroke and makes filing easy.

No handle to buy—no handle to lose—no handle to turn in your hand and ruin your work and temper.

The sheath protects the teeth from rust or injury, fits your pocket and is fine for your tool box.

File is 10 inches long, ⅞ inch wide—just the size that is most useful.

PLUMB
DOUBLE-LIFE

All-Work* File
with sheath

(*Trade Mark Reg. U. S. Patent Office)

It has two faces; double cut (coarse) on one side for fast work, single cut (fine) on other side for a smooth finish.

Two files in one, with forged handle and sheath.

For your pocket, your tool kit, your shop and your car.

35¢ at your dealer's or by mail
(40c West of Rocky Mts.)

Don't put off getting this file, just the one you need for every kind of work.

The better hardware merchants now have the Plumb All-Work File. It's a pleasure to supply you if your dealer can't. Just send the price (stamps will do) and the All-Work File will come to you by the next mail.

FAYETTE R. PLUMB, Inc.
4812 James Street Philadelphia

The Home Workshop

Building Motor-Trucks for a Model Railway

By Edward E. de Lancey

THIS is the second of a noteworthy series of articles on simplified railroad model-making. It explains the general principles of constructing motor-trucks for the beginner whose tool equipment is limited.

THE accompanying illustrations show the construction of a motor-truck. They indicate the method of mounting the motor, the gearing, the swing plate, shoes, and other essential details.

The trailer truck is a duplicate of the motor-truck, but without motor or gearing. However, it must have its own pick-up shoe and perhaps a separate return current brush on one axle.

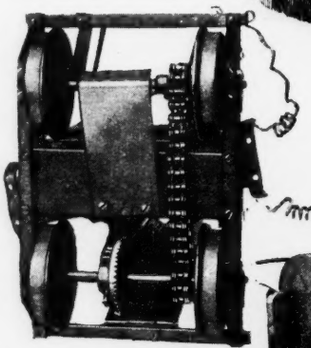
You will have to buy the following supplies:

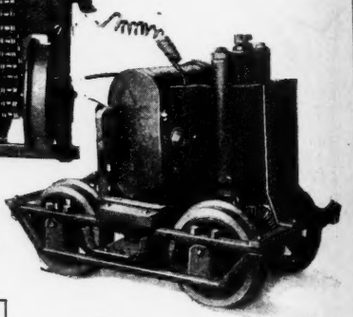
1 pr. bevel gears, 16 and 48 feet respectively. The larger gear usually takes a ¼-in. axle. For the smaller one, ascertain the diameter of the armature shaft with a drill gage and use the indicated size of drill for reboring

2 sprocket wheels with 12 in. of "ladder" type sprocket chain to fit

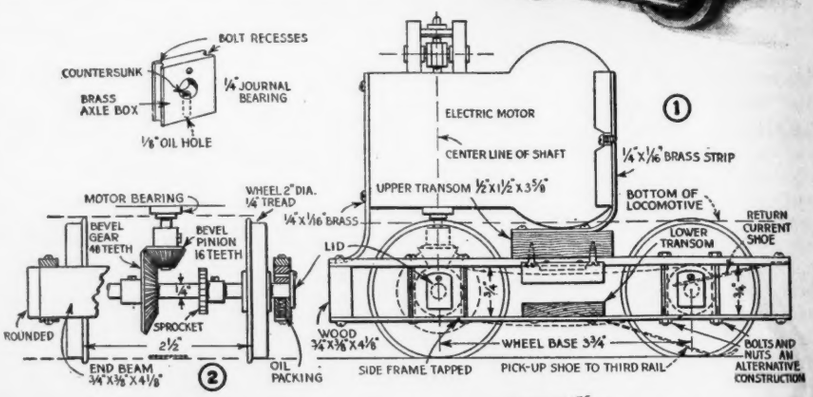
4 pr. 2-in. wheels (preferably with spokes), fitted to axles to a 2½-in. gage, and having journals projecting 5/16 in. beyond the faces of the wheel bosses. Have the flanges *rounded inside and out* and the treads polished

(*Continued on page 101*)





Views showing general arrangement of motor-truck parts. Compare with the simplified construction shown below



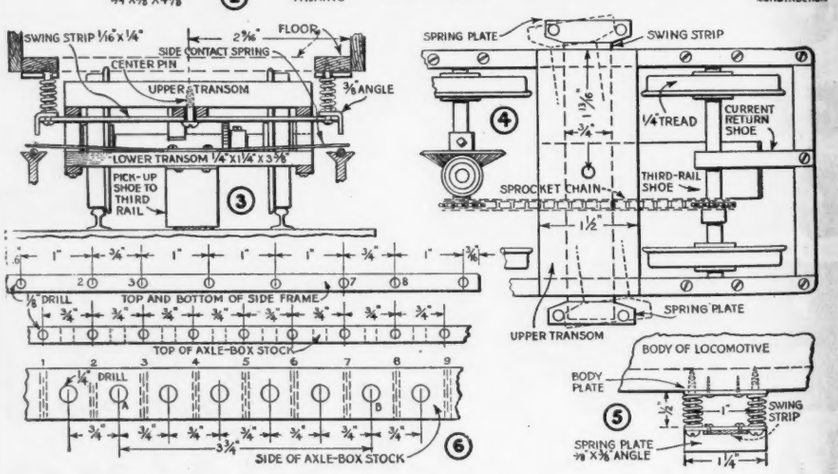


Fig. 1—Side elevation of the motor-truck. Fig. 2—Bevel gearing, sprocket, and section through the journal box. Fig. 3—End view. Fig. 4—Part plan view. Fig. 5—Detail of spring plate and springs. Fig. 6—Method of laying out brass boxes and side frames

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS See page 25.

EVEREADY HOUR
EVERY TUESDAY AT 9 P. M.
(Eastern Standard Time)

For real radio enjoyment, tune in the "Eveready Group." Broadcast through stations

WEAF	New York	WFI	Philadelphia
WJAR	Providence	WCAE	Pittsburgh
WEEI	Boston	WGR	Buffalo

Dry "B" Batteries are an economical, dependable and convenient source of plate current!

Satisfaction Reliability Economy

You need three things in radio "B" Batteries—satisfaction, reliability and economy. You get them all in Eveready "B" Batteries. Satisfaction, because they produce all the current needed by your tubes, giving you the maximum results of which your set is capable. Reliability, because you can depend on them to work at full power. Economy, because they long maintain their strength, and because they are low in price.

Advances in the art of battery manufacture make Evereadys last longer than ever. You actually get much longer service for your money.

There is an Eveready Radio Battery for every radio use.

Buy Eveready Batteries.

Manufactured and guaranteed by

NATIONAL CARBON COMPANY, INC.
New York San Francisco
Canadian National Carbon Co., Limited, Toronto, Ontario

EVEREADY
Radio Batteries Ⓢ
—they last longer

Eveready Columbia Ignitor Dry Cell "A" Battery for all Dry Cell Tubes 1½ volt

No. 766 22½-volt Large Horizontal Price $2.00

No. 772 45-volt Large Vertical Price $3.75

No. 771 4½-volt "C" Battery improves quality, saves "B" Batteries Price 60c

Ⓢ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

A Necessary "Tool" For Your Workshop

FOR the man or boy who has a home workshop, Lee Union-Alls are a handy "tool" to have about. All that is necessary when you want to get busy is to slip into them and start your work. They cover the body from head to foot and can be worn over other clothing. They save clothes, also. And they save time where the hours for such work are limited.

Wear Lee Union-Alls, the *original* one-piece work suit, worn by thousands of mechanics, shopmen, garage workers and industrial workers. Lee Union-Alls are quality-built—close-woven cotton fabric, riveted rustproof buttons, reinforced strain points—fully guaranteed to give satisfaction. They give solid comfort, long wear, and are neat in appearance. Accept no substitute—look for Lee on the buttons. Thousands of live dealers sell Lee Union-Alls. Ask your dealer today!

Lee Union-Alls

THE H. D. LEE MERCANTILE CO.
Kansas City, Mo.

Trenton, N. J.
Minneapolis, Minn.
South Bend, Ind.
San Francisco, Cal

Lee Overalls and Work Shirts are other items in the famous Lee line. They are quality-built, also.

The Home Workshop

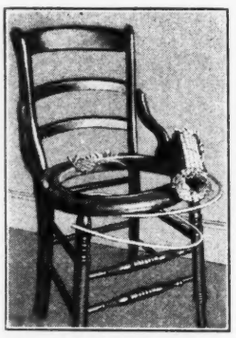
How to Re-Cane Your Old Chairs

The use of machine-woven cane—Steps in weaving the strands by hand

By William T. Weld
Shopwork Instructor, Central High School, Peoria, Ill.

IN YOUR attic or basement there are probably one or more chairs that have been discarded because the caning of bottom or back has been broken. To put chairs like this into use again is not nearly the difficult task that you might imagine. You can repair such chairs and at the same time spend several pleasant hours in your own workshop, or even in the kitchen.

If the chair originally had machine-woven cane, you will notice that all the edges of the cane are held in place by a strip of reed or splines embedded flush in a groove. If the chair is round, first locate the end of this reed. Force a narrow chisel or a small sharp screwdriver between the ends of the spline and start lifting it out of its groove. Place a small flat block as a fulcrum between the chisel and the chair rail or frame and gradually pry up the spline. Square seats usually have four splines mitered at the corners. Clean out the groove with the chisel followed by a little hot water applied with an old toothbrush.



A seat that requires machine-woven cane

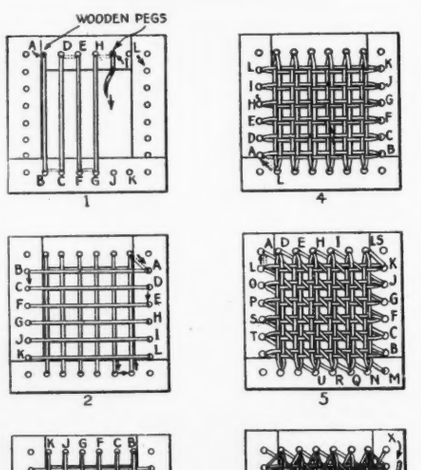


Diagram showing the simple steps by which a hand-woven chair seat is made

IF THE chair needs refinishing, attend to it now. At least the chair should be washed thoroughly with soap and water to which has been added a little ammonia.

Machine woven cane from 10 to 18 in. wide may be purchased by the lineal foot at almost any upholsterer's supply house, and some local furniture dealers carry it in stock. Your piece should be about 2 or 3 in. larger all the way around than the opening in the chair. Both the open and the closed mesh, or matting, may be bought at about the same price.

If you have broken or split the reed spline while removing it from its groove, buy a new one. The size is standard and it comes in lengths of from 8 to 12 ft. Cut off a piece several inches longer than the total length required for your chair and plane or scrape the sides of it until it makes a fairly tight fit in the groove.

Now make three or four wooden wedges for holding the cane in place temporarily. They should be from ½ to 2 in. wide, 6 in. long and tapering from 3/16 to ½ in. Hot cabinet glue is best for gluing in the spline, but a small can of first-class liquid glue placed in hot water until it is quite thin will serve nicely.

Now for the caning itself. Soak the cane in lukewarm water for two or three minutes to soften the fibers a little. Meanwhile pour or spread the glue in the groove and along its sides, using a thin, narrow stick or a small brush.

PLACE the moistened cane over the chair opening with the smooth or glossy side uppermost. Arrange the strands exactly parallel with the front and rear edges of the opening. Let the surplus material extend equally around all four sides.

Beginning at the back, drive in one wedge, forcing the cane down into the groove. Do the same at the center of the front rail, being careful to keep the strands of the cane parallel to the front and rear rails. Repeat at the sides.

With a larger wedge or a caulking iron drive the cane tightly into the groove all the way around. If there are any rounded corners, do these last with a narrow wedge. Your cane is now in place, but the outer edges stick up beyond the surface of the seat. Take a sharp chisel or a heavy knife and, working from the inside, cut off the surplus about 1/16 in. below the surface of the seat. Take great care not to injure the wood.

Some workmen prefer to drive the spline into place *first* and trim off the edges of the cane by cutting carefully against the spline just before it is driven in tightly flush with the seat rails.

Remove each wedge as you encounter

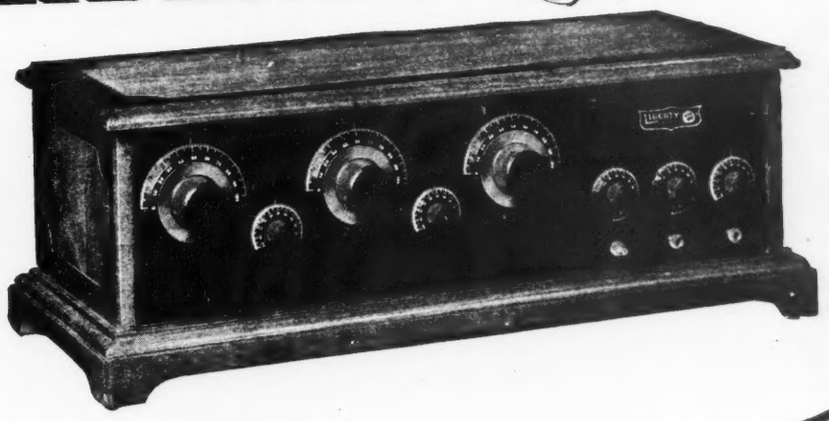
(Continued on page 117)

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

LIBERTY

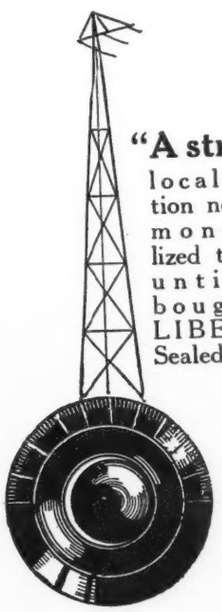
Sealed Five

Delivered Sealed



"My wife said all radio sets sounded 'mechanical' until she heard the LIBERTY. That's why we bought one."

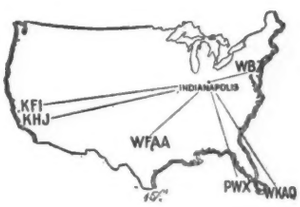
All five tubes are kept 'matched' because each tube is controlled by a **separate** rheostat. That gives pure tone.



"A strong local station near us monopolized the air until we bought a LIBERTY Sealed Five."

LIBERTY is extremely selective. You need no verniers on these large dials.

Owners of the LIBERTY Sealed Five are never without excellent entertainment.



LIBERTY *IS built for the Future*

"I installed one of your Liberty Five radios in my home last week and the first three nights I operated this machine I pulled in the following stations:

KFI	Los Angeles	WCAP	Washington	WCBD	Zion
PWX	Havana	WCAE	Pittsburg	KDKA	E. Pittsburg
KHJ	Los Angeles	WJZ	New York City	WLW	Cincinnati
WBZ	Springfield, Mass.	WMAQ	Chicago	WSAI	Cincinnati
WKAQ	San Juan, P. R.	WOS	Jefferson City	WMH	Cincinnati
WFAA	Dallas	WSB	Atlanta	WTAS	Elgin, Ill.
KYW	Chicago	WHB	Kansas City	WTAY	Oak Park, Ill.
WWJ	Detroit	WDAF	Kansas City	WEBH	Chicago
WCX	Detroit	WOR	Newark, N. J.	WQJ	Chicago
WOO	Philadelphia	WHAS	Louisville	WLS	Chicago
WIP	Philadelphia	WTAM	Cleveland	2XBJ	New York City
WEAF	New York City	WJAX	Cleveland	WREO	Lansing, Mich.
WOC	Davenport	WGY	Schenectady	WLBL	Stevens Point
WHAA	Iowa City	WGN	Chicago	8XG	Willard Test
WBAP	Fort Worth	WCAL	Northfield, Minn.		
WRC	Washington	WHN	New York		

"I think the above test is remarkable inasmuch as I was not familiar with the operation of the set. Might also state that my residence is not located in a very desirable spot for reception but nevertheless the above stations were received in a very clear tone and with plenty of volume on the Loud Speaker.

"I wish you all the success you deserve with this wonderful set.

"Yours very truly,

(Signed) M. E. Mogg, President,
LINTON CONSOLIDATED COLLIERIES COMPANY,
INDIANAPOLIS."

$100

less accessories for this 5-tube tuned Radio Frequency receiver in beautiful two-tone solid walnut cabinet.

I-N-V-E-S-T in a LIBERTY Sealed Five

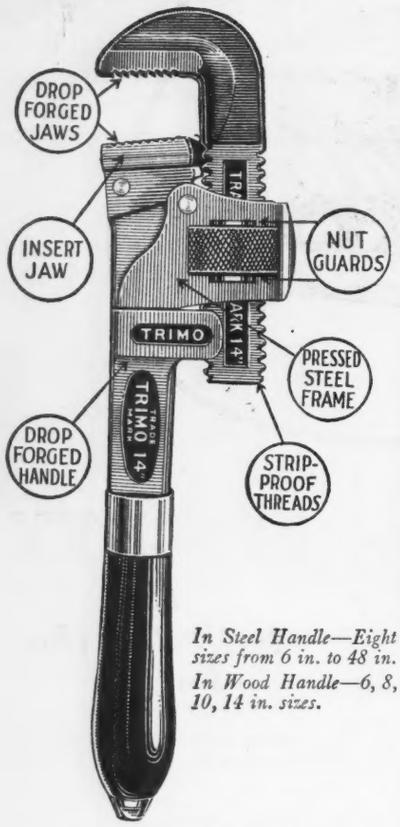
Manufactured by

LIBERTY TRANSFORMER CO., INC.

555 NORTH PARKSIDE AVE., CHICAGO

IS This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

TRIMO



In Steel Handle—Eight sizes from 6 in. to 48 in.
In Wood Handle—6, 8, 10, 14 in. sizes.

A Big Time And Money Saver

HERE are the main reasons why most skilled mechanics, radio fans, householders and handy men demand the TRIMO PIPE WRENCH and will accept no other.

Having a rugged steel frame that WILL NOT BREAK, the brutal strength of the TRIMO guarantees your personal safety when hazardous or tough jobs have to be done.

You can make a TRIMO last for many years because its INSERT jaw in the handle can be renewed at small cost when worn. Handy NUT GUARDS that keep the wrench adjusted, make the TRIMO an ideal tool for working in close quarters.

At most hardware, plumbing and mill supply stores.

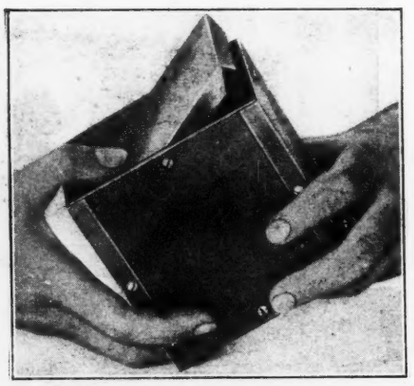
TRIMONT MFG. CO. 122
Roxbury, Mass.
America's Leading Wrench Makers for nearly 40 years

The Home Workshop

How You Can Construct Easily a Trick Savings-Bank for Coins

By Kenneth B. Murray

MR. MURRAY, who is well known to readers of POPULAR SCIENCE MONTHLY for his articles on the construction of ingenious novelties, is an amateur magician of established reputation and an expert on sleight-of-hand illusions. His next article will tell how to make a palming device for cards.



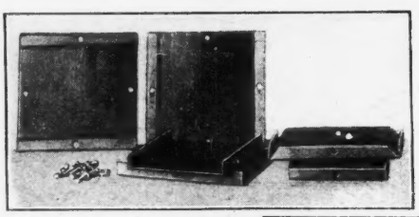


Fig. 1—The parts needed for making the bank

IT IS practically impossible for the uninitiated to open the bank illustrated, simple as its construction is. It can be made at small expense from sheet steel and brass bolts.

The parts necessary are shown in Fig. 1. The wide side pieces for the bank are 4 in. square, while the narrow side pieces and the bottom and top are 3 by 4 in., with flanges of approximately 7/16 in.

Figures 2 and 3 show how the bank is put together with a screwdriver. Special note should be made to fix the brass bolts firmly after each is fastened in place by hammering it as one would clinch a rivet. It must not be possible to unscrew the nut from the bolt. The completed bank is shown in Fig. 5. The secret of the trick bottom is revealed in Fig. 4, which shows how two of the bolts on the bottom are faked. Two of the bolts act as pivots on which the bottom can swing; they are real. The other two consist of the bolt heads only, soldered in place.

When the secretly hinged bottom of the bank is closed, the short projecting ends of the fake bolts catch into corresponding indentations in the bottom, or, better still, although not shown in the accompanying photographs, into holes the same as those for the real bolts. Being a tight fit, the bottom is held by the short bolts securely and it is necessary to exert considerable force with the thumb, as shown in the upper illustration, to open the bank. A coin slot, of course, is made in the top.

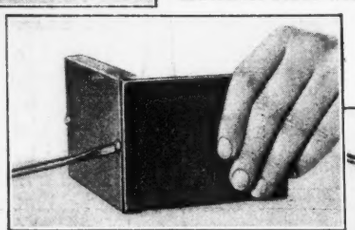


Fig. 2—Fastening a side and an end piece with bolts

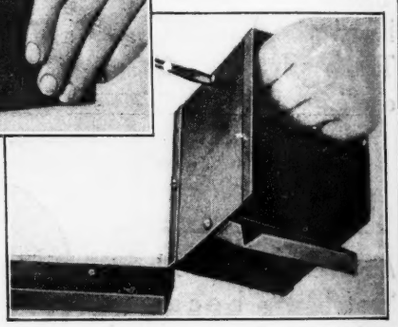


Fig. 3—Putting the top in. Note how the bottom is pivoted on two bolts

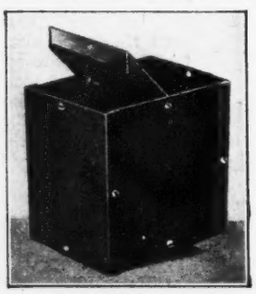


Fig. 4—The bank open

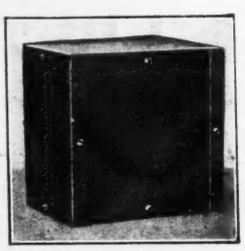


Fig. 5—Ready for use

Waxed Cloth Sometimes Is Useful as Glass Substitute

INSTEAD of glass for the windows of poultry houses, hotbeds, cold frames, and even storm doors, it is possible to use cheesecloth or other light weight white cloth treated with paraffin. The wax, shaved very fine with knife or block plane, is spread on the cloth and pressed into it with a warm but not hot electric iron.

It is important to use plenty of paraffin and to cover only a small section at a time.

The cost of the waxed cloth is about one-half that of ordinary glass. While the cloth does not admit the light like glass, it is transparent enough so that newspaper type can be read through it. —CLAUDE O. SOOTS, North Salem, Ind.

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

Music Master Success

Music Master
Resonant Wood Insures Natural Tone Quality

Model VI, 14" wood bell $30
Model VII, 21" wood bell $35

Connect Music Master in place of head-phones. No batteries. No adjustments.

Prices of all models slightly higher in Canada

—Its True Significance

THE advent of Music Master sounded the death knell of the mere "loud speaker." For it transformed the radio receiving set into a musical instrument—a triumph of re-creative art.

Two years ago Music Master's full voiced volume and characteristic tone qualities heralded the New Era of Radio Art. It made possible the re-creation of supreme Music, Song and Speech, in the wonderful stellar programme now an established feature of American nation-wide broadcasting.

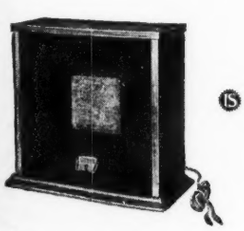
Music Master does more than reproduce—it interprets, it re-creates—it transforms mere radio receiving into artistic enjoyment. Music Master has been imitated often, but without success. Music Master remains the unsurpassed *musical instrument of radio*—and there IS no substitute.

MUSIC MASTER—the Ultimate of Artistic Radio Re-Creation

Music Master's precision instrument is the acme of scientific perfection. Music Master's tone chamber of heavy cast aluminum is a marvelous mold of sound without distortion. Music Master's amplifying bell of resonant wood gives to every sound its full, vibrant qualities and natural and lifelike characteristics.

Music Master's manufacturers hold that every purchase of their product carries with it an implicit pledge of unreserved and unconditional protection. Back of your dealer's full and unfailing service stands the Music Master Corporation to guarantee its products *direct*, to anyone, anywhere, at any time.

Model VIII, Mahogany Cabinet with "full-floating" wood horn $35



Model V, wood bell, Metal Cabinet, Mahogany finish $18

Music Master Corporation

Makers and Distributors of High-Grade Radio Apparatus
Tenth and Cherry Streets
Chicago Philadelphia Pittsburgh
Canadian Factory: Kitchener, Ontario

Ⓢ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

An awkward job made easy by the "YANKEE" Ratchet Tap Wrench

HE had to tap a thread in the transmission case for a magneto plug screw.

Without a "Yankee" Tap Wrench he would have been compelled to remove the coil box.

But the "Yankee" Tap Wrench made this unnecessary. He just pulled the sliding cross bar out to end position, where his hand could move freely; set the Ratchet Shifter, and tapped the hole quickly and easily.

Three adjustments. Right-hand Ratchet, Left-hand Ratchet and Rigid. Knurled finger turn at top quickly starts or backs out taps.

No. 250—Length 3¼ in. Chuck diam., ¾ in. Holds up to 3/16 in. taps.
No. 251—Length 5 in. Chuck diam. ⅛ in. Holds up to 5/16 in. taps.
No. 1251—Length 13 in. For jobs needing long reach. Otherwise same as No. 251.

Some Other "YANKEE" Tools

Spiral Screw-drivers *Quick-Return Spiral Ratchet Breast Drills* *Screw-drivers*

Let us mail this Book to you FREE!

If you like tools you'll want this FREE "YANKEE" Tool Book

Shows every "Yankee" Tool, and tells you all about them. Write for your copy today.

"YANKEE" on the tool you buy means the utmost in quality, efficiency and durability. Dealers Everywhere Sell "Yankee" Tools.

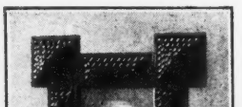
NORTH BROS. MFG. CO., Philadelphia, U.S.A.

"YANKEE" TOOLS

Make Better Mechanics

The Home Workshop

Easily Made Cigar-Box Novelties



THE picture-frame and candlestick illustrated can be made at home more easily than almost any other piece of woodwork. It is not necessary to copy either design exactly; the method can be used with endless modifications and for ornamenting many objects, including boxes, bookends, stationery racks, inkstands, sewing trays, and the like.

The tools needed are few—a rule, a pocket-knife, and a piece of sandpaper, and, if available, a small plane, a square, a coping-saw, and a file.

All the wood is taken from empty cigar boxes. Boxes made of Spanish cedar (a red wood that looks like mahogany) will produce the best effect, but any kind of wood can be used and stained the desired shade. A combination of various colors of wood, however, should be avoided.

Notching blocks (at left), gluing them in place (above), and planing a thin strip (at right)

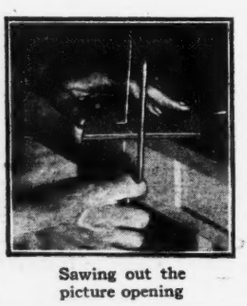
Select a good cigar box, take it apart carefully, scrape off the paper and clean with sandpaper held on a small block. Lay out the frame (or whatever part is to be made) and use a knife to cut the outline deep into the wood. Cut a hole in the waste material to allow a coping-saw blade to be inserted; then cut out the center rectangle. If a coping-saw is not at hand, cut deeply with the knife from both sides until the wood is removed. Make the cuts on the outside edges with saw and knife, or with the knife alone. Smooth up the inside and outside edges with a wood file or sandpaper.

Make the square and rectangular blocks used to build up the surface as indicated. The edges and ends can be sandpapered best by laying the sandpaper down and moving the block over it. Lay out the spaces for the notches on the edges of the blocks 3/16 in. apart as nearly as possible. The divisions must come out even. Cut the notches with a thin, sharp knife, making them clean and square. The file or sandpaper is not used on them.

Mark the places for the blocks on the frame, heat the pieces slightly, if convenient, and glue them in place. Hot animal glue is quick-drying and satisfactory, but a good liquid glue will serve the purpose. Liquid glue is handled more easily when heated.

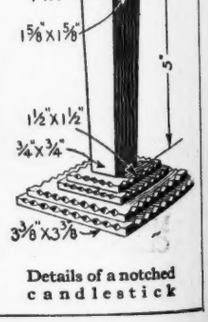
While the glue on the surface of the frame is drying, make the strips to hold the glass and the picture in place on the back, and glue them. A few fine brads may be driven from the back to add strength, but do not drive them until the glue holding the blocks is absolutely dry. Then glue on the back piece proper. The glass and picture space is left open at the top so that the picture may be changed at any time. The frame may be made either to hang on the wall or to stand on a table or a dresser.

Apply a coat of mahogany stain and one or two coats of thin shellac or varnish.



Sawing out the picture opening

In making the candlestick, the upright piece is composed of four thin pieces of wood, joined boxlike to form a post 1 in. square at the top and ¾ in. at the bottom. An auger bit can be used in making the hole for the candle, but the coping-saw or even the knife alone will do the work. If an auger bit is used, cut out some wood for the "spur" of the bit or it will crack the board. It is also well to make the hole on a larger piece and afterward trim the piece to the required size. A piece of green felt under the candlestick finishes it off.—E. E.



Details of a notched candlestick

IS This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

The Home Workshop

Building Model Motor-Trucks

(Continued from page 94)

1/8 by 1/4 by 40 in. strip brass for upper frame
1/16 by 1/4 by 80 in. strip brass for lower frame and motor fastening
1/16 by 3/4 by 18 in. brass for swing strips and extras
1/4 by 3/4 by 8 in. brass for axle boxes
3/8 by 3/8 by 8 in. angle brass for spring plates
1/16 by 3/8 by 12 in. strip brass for journal-box lids
1/4 by 12 in. thin spring brass for contact shoes
Open spiral spring 3/16 in. in diameter, 12 in. long, for body springs
1 box 3/32 by 1/4 in. machine screws with tap and drill to suit
1 box 1/8 by 1 in. machine screws with tap and drill to suit
1 box 3/4-in. round-headed wood screws for end-beam fastenings, etc.
1/2-in. flat-headed wood screws for attaching upper bolsters, etc.

These lengths and amounts are in excess of actual requirements to allow for unavoidable waste and spare stock

In the way of tools you will need:

An assortment of twist drills containing at least every alternate size from No. 10 to No. 60
A drill gage from 0 to 60
A breast or electric drill stock to hold up to 1/4-in. drills
1 doz. fine 8-in. hacksaw blades with frame
1 doz. fine scrollsaw blades with frame
A few flat, three-cornered and rat-tail files
An assortment of square- and round-nosed pliers with wire cutters
Medium-size tin snips
A small anvil
A vise with jaws at least 2 1/2 in. wide

Ordinary household tools, such as light and heavy hammers, saws, and the like, are taken for granted. If possible, provide yourself with a pair of calipers, a set of small taps and dies, with tap wrench and die stock, in sizes from 1/4 in. up. The 1/8-in. size will be handy when you come to making controller handles and similar work. You may also require 16 1/8 by 1 in. bolts such as can be had from any dealer in model-making supplies, but these will be mentioned later on. Make sure that all your brass stock is square, flat, and free from warp

LET us begin with the axle boxes. Study Fig. 6 of the mechanical drawings on page 94—the top and side views of the journal box stock after it has been drilled. The 1/4-in. holes are for the journals and the 1/8-in. holes are for the bolts that hold the journal boxes.

Before being cut apart, the strip of boxes forms an excellent templet for boring the box bolt holes in the upper and lower side pieces. Remembering that the wheel base of the truck is 3 3/4 in., note that the journal holes *A* and *B* are also 3 3/4 in. apart. From this it follows that the bolt holes 2 and 3 and 7 and 8 *must* correspond with the bolt holes in both upper and lower side frames.

For the side frames, cut 8 pieces 7 in. long; 4 of these are 1/8 in. and 4 are 1/16 in. thick. The lower frame is only 1/16 in. thick, while the upper is 1/8 in. thick. Take one of these pieces and scratch a mark across it precisely in the center. Now place it in the vise with the still assembled boxes so that the 1/4-in. faces of each piece are in accurate contact through their entire length and bolt hole No. 5 exactly bisects the scratches in the center of the 1/8 by 1/4 in. frame piece.

NOW, using a 1/8-in. drill and bolt holes 2 and 3 and 7 and 8 as guides, drill through the side frame. Remove the journal box piece and putting the frame piece alone in the vise, drill a 1/8-in. hole 1/2 in. each side of the center scratch, and another 1/8-in. hole with its center 3/16 in. from each end of the frame piece. If you have been careful to see that all holes have been drilled accurately along the

(Continued on page 102)

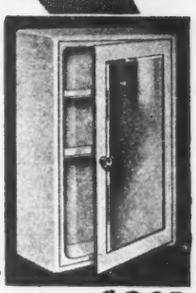
SAVE HALF - INSTALL YOUR OWN
PLUMBING AND HEATING
BY OUR *New Easy Method*

CHICAGO HIGH GRADE BATH-ROOM OUTFIT $59.95

Complete Bathroom Outfit, built along practical and attractive lines. Highest grade possible to make. Shows that First Quality Hardin-Lavin products can be had at low cost.

WHITE ENAMELED BATH TUB Cast Iron, heavy white porcelain, enameled inside and over the 3¼ inch turned-over rolled rim; outside painted. Newest Design. Fitted complete with heavy brass, nickel-plated compression bath faucet, with china indexed handles, nickel-plated heavy brass adjustable waste and overflow and supply pipes to floor; width 30¼ in., length 4½ or 5 ft., weight 300 lbs.

Chicago A-50—Bathtub complete as shown with iron-pipe connections. Special **$31.10**



White Closet Outfit

Improved, snow-white composition Chino Closet tank (beautiful and indestructible); fitted with solid brass elevated noiseless valves and improved china flushing handle. Highest grade white vitreous China syphon washdown bowl. Highly polished, reinforced birch mahogany seat, with heavy brass, nickel-plated bar hinges, flushing ell, supply pipe, closet bolts, etc., weight 125 lbs.

Chicago A-52—White Closet Outfit, complete as shown with iron-pipe connections. Special..... **$19.95**

Medicine Cabinet, Special..... $8.95

Highest Grade White Enameled Steel; all joints electrically welded before enameled with four coats of baked enamel, inside and out. Has plate glass bevelled mirror, two plate glass shelves, heavy glass knob and enameled non-sag hinges. Cabinet is guaranteed to be entirely satisfactory and carefully crated to reach you in first class condition. Hang on any wall with two screws. Height 21 in., width 16 in., depth 5 in., wt. 35 lbs.

No. 5137—White enameled Cabinet, Special, reduced to..... $8.95

ANY HANDY MAN can install his own Plumbing and Heating by our New Easy Method and Save Half. In the past 50 years, we have saved our customers hundreds of thousands of dollars in the cost of: Plumbing Goods, Pipeless and Warm Air Furnaces, Steam Boilers, HotWater Boilers, Water Supply Systems, Water Heaters, Bathroom Outfits, Pipes, Radiators, Valves, Supplies, etc.

BIG HANDY MAN BOOK

Tells the whole story. Shows the Hardin-Lavin New Easy Method. Send coupon with 25c (regular price 50c, refunded on first order) for your copy today. This Big, Instructive, Well-Bound "Handy Man" Book-Catalog shows 10,000 items in latest style, highest quality Plumbing and Heating Fixtures and supplies at Wholesale Prices.

Hundreds of Trade Secrets

Also shows many valuable diagrams, plans and elevations of simple installing systems, trade secrets and money, time and labor saving kinks. Most valuable book of its kind published. SEND 25c FOR YOUR COPY TODAY.

Bonded Guaranty

We guarantee that every article we sell from the smallest fitting to a complete installation is perfect and exactly as shown and of the HIGHEST GRADE that is possible to manufacture. We further guarantee that if you are dissatisfied for any reason, you can return any goods bought from us and we will immediately refund your money plus freight charges you have paid. (Signed) HARDIN-LAVIN CO.

Could Anything Be Fairer?

Read Our Guarantee

Write this magazine or your bank about our 50 years' record of square dealing and about our new million dollar plants. ORDER TODAY AND SAVE. YOU CANNOT LOSE.

Deep Apron Lavatory

Late design, white porcelain enameled, cast-iron drop apron lavatory, supported on concealed wall hangers; new low design, china indexed compression faucets, heavy brass, nickel-plated adjustable supply pipes and trap to floor or wall, size 17x19½ in., weight 120 lbs.

Chicago A-51—Lavatory. Complete as shown with Iron-Pipe connections. Special..... **$11.75**

Chicago A-53—Bathroom outfit, complete as shown and described. Special..... **$59.95**

All shipped from Chicago plant same day as order is received. Order today. You cannot lose.

Hot Water Boiler

Heating Plants Cut-To-Fit
Hot Water—Steam—Hot Air—Pipeless

Hardin-Lavin Cut-To-Fit Hot Water Heating Plants give highest heat efficiency at lowest cost. Boiler embodies best engineering; easy dumping grates; long indirect fire travel that insures complete combustion and greatest heat. Our modern equipment and 50 years' practical experience qualifies us to produce this boiler that will burn any kind of fuel, cleanly, completely, and economically. WE HELP YOU PLAN. Every Hardin-Lavin Heating System is figured to eliminate long runs of piping, to save valuable time, and expensive labor. With our complete instructions and simple installing features, you can do the work yourself and save. We loan the tools if necessary. WRITE TODAY FOR LOW WHOLESALE PRICES.

Pipeless Furnace

Free Estimate

Send us rough sketch, plan or blue print of your home and we will figure the wholesale cost of a simplified cut-to-fit Heating or Plumbing System that exactly meets your needs. We will show you many wrinkles where you can make money savings that will surprise you. Our Bonded Guarantee protects you. Behind this, stands our million dollar plants and record of 50 years.

MAIL COUPON TODAY

HARDIN-LAVIN CO.
Established 1878

Whoe in Chicago, visit our new plant at 106-16 W. Pershing Rd., Chicago

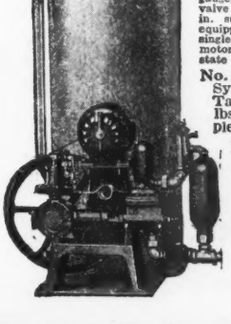
Super Improved Automatic Electric Water Supply System

Absolutely reliable, fool-proof and simple. Can be depended upon to give lasting service with practically no attention. No better outfit made for SHALLOW WELLS OR CISTERNS WHERE WATER IS NOT OVER 22 FEET BELOW SURFACE.

Complete **$98.50**

Noiseless Pump Runs in Oil

Noiseless, double acting, brass fitted throughout and fully enclosed and lubricated by the "New Splash System." All moving parts run in oil bath which insures long life. Latest type oversize 1-6 Horse Power electric motor, operates economically and is thoroughly reliable; surplus power to drive pump under all conditions.



Outfits Complete—No Extras

System consists of pump with automatic air valve, oversize 1-6 Horse Power repulsion induction motor, automatic switch set at 40 lbs., relief valve, shut-off valves, necessary pipe and fittings as shown; one galvanized heavy pneumatic tank with pressure gauge, one ¾ in. galvanized foot valve and strainer. Pump has ¾ in. suction and discharge. Outfit equipped with 60 cycle, 110-220 volt, single-phase alternating current motor. If you have other current, state voltage, etc.

No. A.—500. Water Supply System with 42 Gallon Tank. Shipping Weight 300 lbs. Price, complete, Special **$98.50**

No. A.—501. Water Supply System with 80 Gallon Tank. Shipping Weight 340 lbs. Price, complete, Special **$110.50**

No. A.—502. Water Supply System with 100 Gallon Tank. Shipping Weight 380 lbs. Price complete, Special **$122.50**

HARDIN-LAVIN CO., 106-16 W. Pershing Rd., Chicago, Ill.

Gentlemen: Enclosed please find 25c (¼ regular price) for which send me your Big Complete "Handy Man" Book-Catalog with special **Wholesale** discount sheets and FREE Bulletin Service. I am interested in:

( ) Water Sply. System ( ) Plumb. Fixtures
( ) Steam Heat. Plant ( ) Bathroom Outfits
( ) H. W. Heat. Plant ( ) Pipeless Furnace

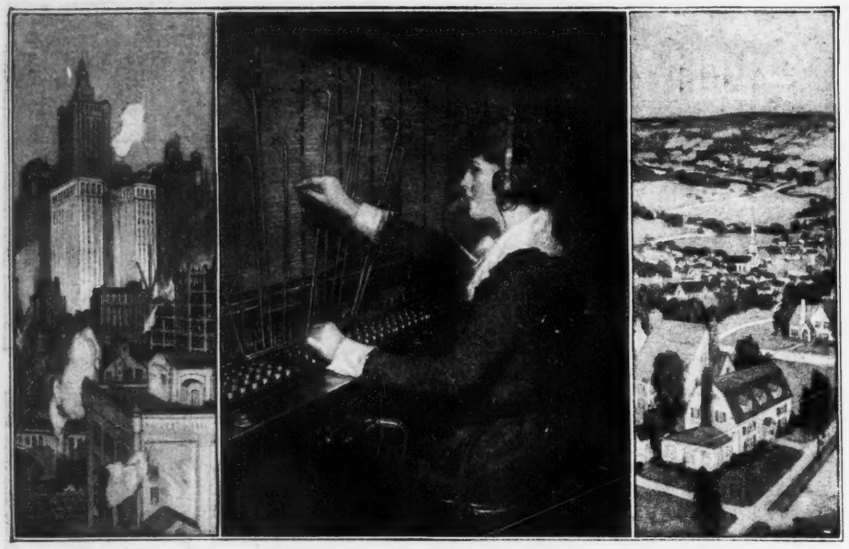
Note: "Handy Man" Book is FREE if order accompanies coupon.

NAME.....

ADDRESS.....

CITY.....STATE.....

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.



At Your Service

The courteous girl at the switchboard speaks the first word in more than two million conversations an hour. Presiding day and night at the busy intersections of speech, she is always at the call of the nation's homes, farms and offices.

Out of sight, and most of the time out of hearing of the subscribers, little is known of the switchboard girl—of her training and supervision under careful teachers, and of her swift and skilful work. Likewise, little is known of the engineering problems necessary to bring the terminals of fifteen million telephones within the reach of a girl's arm, or of the ceaseless work of maintenance which in fair weather and storm keeps the mechanism fit and the wires open.

America's millions of people must have at their command means of direct and instant communication, and the Bell System must ever be in tune with the demands of national service.

These are the components of America's system of telephony: The best of engineering, of manufacture, of facilities—and a personnel trained and eager to serve.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES
BELL SYSTEM
One Policy, One System, Universal Service

$25.00 in PRIZES See top of page 8 in front of book for details.

Buy Now Pay Later!

Let Boice Help You Build It!
No matter what you want to build. Boice can help you. He'll send you the
Boice-Crane Junior Saw Ⓢ
or any other Boice-Crane machine on monthly payments. He gives you unsurpassed prices and values with a positive money-back guarantee. Machine shown will saw, sand, grind, miter, rabbet, tenon, etc. Sturdy, accurate, economical. Saws 1 5/8" stock. Sold with or without motor.
Write today, for Descriptive Catalog of Bench Saws, Drills, Jointers and Band Saws and the Boice E-Z-Pay Plan.
W. B. & J. E. BOICE
Dept. P. S. 4-A, Toledo, Ohio
"World's Largest Makers of Small Bench Machines"

Pay a few cents a day the Boice way!

The Home Workshop

Building Model Motor-Trucks

(*Continued from page 101*)

center line, the frame piece may be used as a templet for the remaining frame pieces. Unless you have access to a drill press, it is advisable to have the drilling of at least the journal box stock done at a machine-shop.

You now can cut apart the journal boxes with a fine hacksaw. Follow carefully the center lines of the bolt holes.

Either 1/8 by 1 in. machine screws or bolts may be used for securing the journal boxes to the frame. If screws are used, the holes in the lower frame piece must be slightly less than 1/8 in. so that they can be tapped. This method necessitates drilling the 4 upper and 4 lower frame pieces separately, but is cheaper and avoids the possibility of losing any nuts. The bolt method is shown at the right of Fig. 1, and the machine-screw method at the left.

A refinement in the journal boxes, which may be introduced if desired, is illustrated in Fig. 2. A 1/8-in. hole is drilled from the center of the bottom of the box until it intersects the bottom of the journal hole. This is for holding a bit of cotton waste for lubrication. If you drill this hole, remove the burr by filing a depression not more than 1/32 in. deep in the bottom of the journal hole.

YOU now may attach the journal-box lids. Just above the top of each journal hole, drill a hole a trifle smaller than your 3/32-in. machine screws and tap this. Then cut the box lids from 1/16 by 3/8 in. strip brass, as in Figs. 1 and 2. Round off the top of the lids and drill a hole for the screw large enough to admit the screw clear to its head, so that the lid can be screwed down tightly enough to act as an end stop for the journal.

When your four side frames and boxes are assembled, you are ready to add the wooden end beams and transoms. Trim three strips of fairly hard, straight-grained wood, each about 18 in. long, to the cross sections shown. See that the edges are truly at right angles and all surfaces smooth and free from warp. There must be no knots.

Cut four pieces from this stock 3/8 by 3/4 by 4 1/8 in. long for the end beams and round the ends, as in Figs. 1 and 2. Take two of the assembled brass frames and with the box lids screwed flush with the boxes, slip them over the journals. Hold them together temporarily with two rubber bands. Then insert the end beams, making sure their ends project equally at the corners. Mark the locations of the corner screw holes on the *upper side*, removing the end beams, and drill for 3/8-in. round-headed wood screws. Insert the screws, turn the truck upside down, mark and drill for the under side, and square the whole frame.

It is vitally important to maintain squareness throughout your work. Employ a small try-square constantly. The two trucks at this stage should run as smoothly as a billiard ball.

The next article will take up the wooden bolsters and the mounting of the motor, gearing, and springs.

Ⓢ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

Mistakes in Painting

Household Painting Guide

SHERWIN-WILLIAMS HOUSEHOLD PAINTING GUIDE

TRADE MARK

SURFACE	TO PAINT— USE PRODUCT NAMED BELOW	TO VARNISH— USE PRODUCT NAMED BELOW	TO STAIN— USE PRODUCT NAMED BELOW	TO ENAMEL— USE PRODUCT NAMED BELOW
AUTOMOBILES	S-W Auto Enamel	S-W Auto Enamel Clear		S-W Auto Enamel
AUTOMOBILE TOPS AND SEATS	S-W Auto Top and S-W Auto Seat Dressing			
BRICK	SWP House Paint S-W Concrete Wall Finish			
CEILINGS, Interior	Flat-Tone	[illegible] Varnish	S-W Handcraft Stain Floorlac	Enameloid
Exterior	SWP House Paint	Rexpar Varnish	S-W Oil Stain	Old Dutch Enamel
CONCRETE	S-W Concrete Wall Finish			
DOORS, Interior	SWP House Paint	Scar-Not Varnish Velvet Finish No. 1044	Floorlac S-W Handcraft Stain	Enameloid
Exterior	SWP House Paint	Rexpar Varnish	S-W Oil Stain	Old Dutch Enamel
FENCES	SWP House Paint Metalastic S-W Roof and Bridge Paint		S-W Preservative Shingle Stain	
FLOORS, Interior (wood)	S-W Inside Floor Paint	Mar-Not Varnish	Floorlac	S-W Inside Floor Paint
Concrete	S-W Concrete Floor Finish			S-W Concrete Floor Finish
Porch	S-W Porch and Deck Paint			
FURNITURE, Indoors	Enameloid	Scar-Not Varnish	Floorlac	Old Dutch Enamel
[illegible]	Enameloid	Rexpar Varnish	S-W Oil Stain	Enameloid
HOUSE OR GARAGE Exterior	SWP House Paint	Rexpar Varnish	S-W Preservative Shingle Stain	Old Dutch Enamel
LINOLEUM	S-W Inside Floor Paint	Mar-Not Varnish		S-W Inside Floor Paint
RADIATORS	Flat-Tone S-W Aluminum or Gold Paint			Enameloid
ROOFS, Shingle Metal Composition	S-W Roof and Bridge Paint Metalastic Ebonol		S-W Preservative Shingle Stain	
SCREENS	S-W Screen Enamel			S-W Screen Enamel
TOYS	S-W Family Paint	Rexpar Varnish	Floorlac	Enameloid
WALLS, Interior (Plaster or Wallboard)	Flat-Tone SWP House Paint			Old Dutch Enamel Enameloid
WICKER	Enameloid	Rexpar Varnish	Floorlac	Old Dutch Enamel
WOODWORK Interior	SWP House Paint Flat-Tone	Scar-Not Varnish Velvet Finish No. 1044	S-W Handcraft Stain S-W Oil Stain Floorlac	Old Dutch Enamel Enameloid

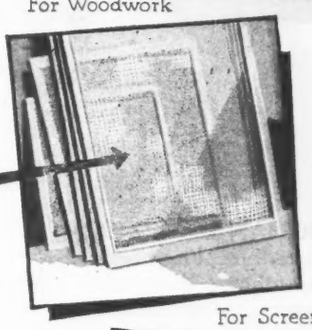
For Removing Paint and Varnish use Taxite—quick—easy—thorough—economical—can be used by anyone—on any surface.

SHERWIN-WILLIAMS PAINTS AND VARNISHES

For Cleaning Painted and Varnished Surfaces use Flaxoap. Made from linseed oil—contains no free alkali—restores original lustre.

For the Garage

For Woodwork



For Screens

For Furniture

How To Hire a Painter

Give the job to a *good* painter when you hire a man to paint your house. "Paint Headquarters" will recommend good men. Good painters are worth knowing. *If you hire a painter, hire a good one.*

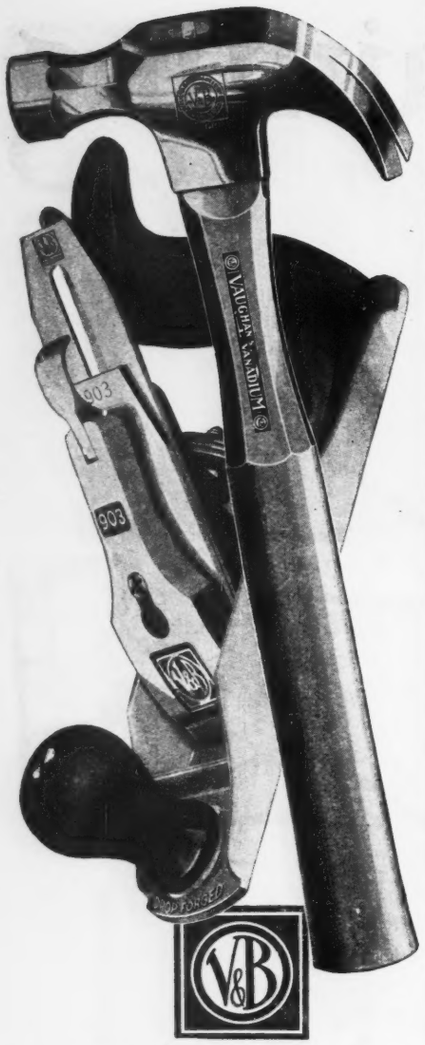
New!

SHERWIN-WILLIAMS

Payment Plan

Arrangements have now been perfected by Sherwin-Williams whereby the painting of residential property may readily be arranged on a convenient payment basis. Recognized business practise is now, therefore, made available to the property owner without difficulty or red tape. The Sherwin-Williams "Paint Headquarters" Dealer will gladly give you full information.

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.



VAUGHAN & BUSHNELL Vanadium Hammers are aristocrats among hammers. Made from special formula vanadium steel—handled with the best grade hand-shaved second growth white hickory—designed with a special non-slip claw that grips either a brad or a spike— and equipped with a Vaughan's Expansion Wedge that firmly locks the handle tight—they are made for you craftsmen that buy quality tools.

V & B Unbreakable Planes bear the same reputation as V & B Vanadium Hammers. They are drop forged—not cast—from a solid bar of V & B Supersteel, and stand the falls and accidents that would break an ordinary plane. They are furnished with all vanadium steel blades and walnut handles in the sizes you'll want.

Your hardware dealer will heartily recommend these two tools. Ask to see them when next you are in!

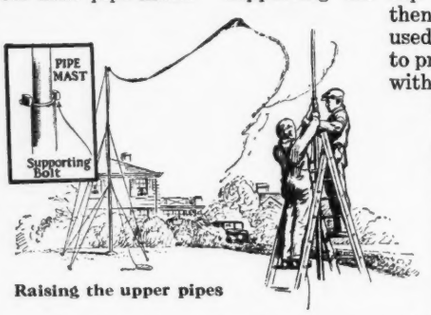
VAUGHAN & BUSHNELL MANUFACTURING COMPANY
Makers of Fine Tools
2114 Carroll Ave. Chicago, Ill. U.S.A.

The Home Workshop

How to Erect an Aerial Pipe Mast

By B. Francis Dashiell

THE erection of aerial masts has often resulted in the marring of attractive lawns or homes with unsightly, makeshift poles. Those radio fans who have attempted to erect neat pipe masts frequently have given up in disgust and discarded the bent, twisted, and unmanageable remains of their unsuccessful efforts. It is almost impossible to erect a 50-ft. mast after the pipes have been assembled, as it will bend, vibrate, and twist.



Raising the upper pipes

The most practicable method is to telescope three lengths of different sized pipe. The smallest or upper section should not be less than ¾-in. pipe size. Set up the telescoped pipes in a hole 4 or 5 ft. deep. Fill in with concrete or well tamped earth and use three guy wires to brace the largest or lowest section.

Two men, working from ladders placed on opposite sides of the erected pipe, then raise the top or smallest section until it has been lifted three-quarters of its length out of the middle section. A bolt is slipped through a hole previously drilled for that purpose, so as to prevent this section from telescoping or sliding down within the next larger size.

The middle or second section (now supporting the top or smallest section) then is raised and a bolt used in a similar manner to prevent its telescoping within the largest or lowest section.

Guy wires, which were previously attached to the top of the second section, are fastened to the same anchor posts used for the guys of the lowest section. It is not necessary to attach guys to the top section, but it is well to use a single wire to counteract the pull of the aerial wires.

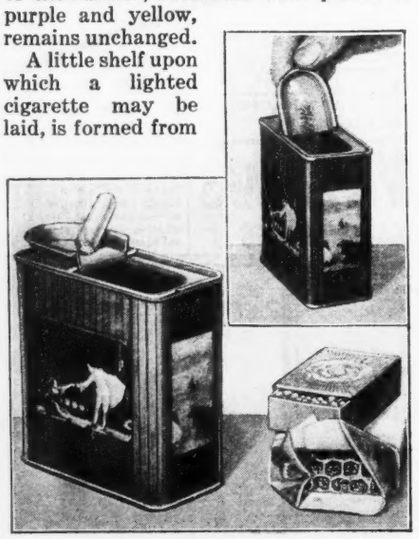
By using this method a 50-ft. mast may be raised in less than one hour. It is important, however, to select pipes that slide or telescope easily. Three 20-ft. lengths will make a mast that will be from 45 to 50 ft. high. Because of the weight of the pipe, it is not advisable to use more than three pieces. One advantage of this method is that the pipes can be painted before erection, and lowered when necessary for repainting.

Old Can Forms Ash Receiver

THE ash receiver illustrated costs nothing to make, has a large capacity, and will not readily spill.

It is made from a can that contained toasted almonds. Pictures are pasted over the reading matter, while the rest of the surface, decorated with panels of purple and yellow, remains unchanged.

A little shelf upon which a lighted cigarette may be laid, is formed from the lid. This is cut across one-third the distance from the end. One end of it is bent to form a hinge joint around a piece of stout wire or a nail, which is soldered in place as shown.—EDWARD H. FLAHARTY.


An ash receiver of large capacity

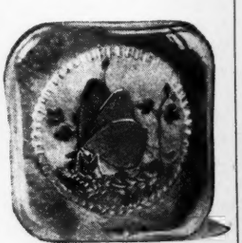
Butterfly Paperweight Is Attractive Desk Ornament

By Clyde E. Volkers

IF YOU have stored away somewhere a discarded glass paperweight, you can convert it into an attractive desk ornament by replacing the colored print with a small butterfly or moth.

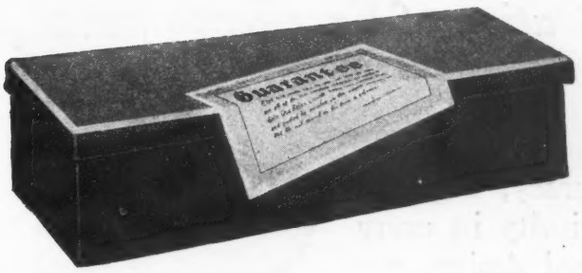
The glass first is cleaned thoroughly. Cut a piece of stiff paper or thin cardboard that will fit the bottom of the paperweight. In the hollow cavity of the glass, place the butterfly so the more attractive side will be seen from the top. Arrange a piece of brightly colored grass, or a dainty bit of flower over the butterfly. As a background use a thin sheet of white or stained cotton or the silky down from milkweed pods.

Glue the cardboard to the back of the weight to hold the cotton, flower, and butterfly in place. Acetic glue is excellent for this purpose. It is made by heating 18 parts of glue flakes (previously softened by soaking overnight in a little cold water) with 2 parts of acetic acid until a thick liquid is formed.


A unique paperweight

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

CIR-KIT



More Power per Tube brings Greater Radio Most Economically

Triple power is the basis of Erla Supereflex records. Tubes, as used in Supereflex, simultaneously amplify received radio frequency currents, reflexed radio and reflexed audio frequency currents. So 1-tube Supereflex rivals the power of conventional 3-tube circuits. And 3-tube Supereflex readily outclasses the ordinary five!

Only such power can give you the thrill of Supereflex distance and volume; always with Erla crystal-pure tone—and with uncanny selectivity that gets what you want when you want it.

This finer radio is brought within the reach of all by Erla Supereflex CIR-KIT, the factory-sealed carton of genuine Erla apparatus for building Supereflex yourself. Anyone can follow the CIR-KIT assembly plan perfectly, using only screwdriver and pliers, without drilling or soldering.

Pride of workmanship, extreme economy, priceless radio performance, are yours in Erla Supereflex CIR-KIT. Select your model at the Erla store. 1 to 5 tubes, antenna and loop types.

SEE ERLA RECEIVERS

Inherent Erla advantages in power, tone and selectivity are now available in beauteous complete Erla receivers. Retail prices range from $67.50 to $225. Both price and performance place Erla receivers among the sensations of radio history.

Electrical Research Laboratories
Department S, 2500 Cottage Grove Avenue, Chicago

ERLA

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

The Fine Finish of

BROWN & SHARPE TOOLS

Is Part of Their Quality—

An Indication of Excellence

High accuracy, together with superiority in every point of tool design, are basic qualities in Brown & Sharpe Tools. Fine finish is one of these qualities. Just examine closely any Brown & Sharpe Tool. Its fine finish is an indication of its excellence—an excellence which can be had only in Brown & Sharpe Tools.

Have you seen the new Brown & Sharpe Small Tool Catalog No. 29? Let us send you a copy.

Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.

BROWN & SHARPE TOOLS

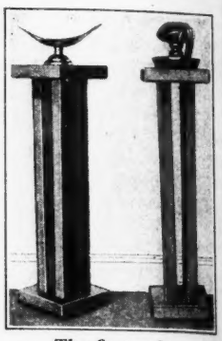
"Standard of the Mechanical World"

The Home Workshop

Few Tools Needed to Build Sturdy Wooden Plant Stands

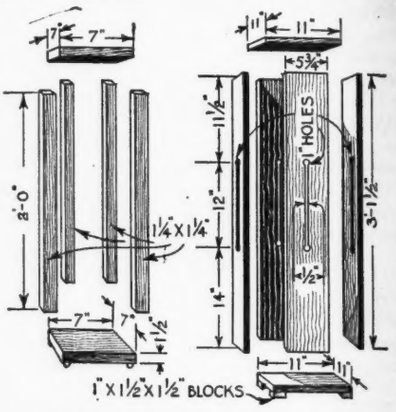
THERE is a Robinson Crusoe streak in all of us. If the first trial of a joint in either woodworking or metal-working proves an error, what of it? The second or third will be right.

Even the would-be mechanic who has never made as much as a box, will learn how true this is if he will try his hand at making a pair of pedestals or stands by either of the methods shown in the accompanying drawings.



The first pair

The tools needed are a saw, a plane, a hammer, a coping or compass saw, brace and bits, a square, and a nail-set. You can get the wood planed to size at the mill. All



Details of the first pair are shown at the left; of the second pair, at the right

The second pair

you need to do is to saw off the pieces to the length shown, square the ends, and put them together. No mortises or tenons or doweled joints are used.

Allowing for some waste, the material needed for the first pair of pedestals illustrated is as follows:

2 pcs. 1¼ in. square, 9 ft. long
1 pc. 1¼ in. thick, 7 in. wide, 3 ft. long
8 large rubber-headed tacks
½ lb. tenpenny finishing nails
2 sheets No. 0 sandpaper

Saw the 9-ft. pieces into eight 24-in. lengths, seeing that the ends are square. Cut the 3-ft. piece to make four 7-in. squares, which will form the tops and bottoms. Draw diagonal lines across the

(*Continued on page 109*)

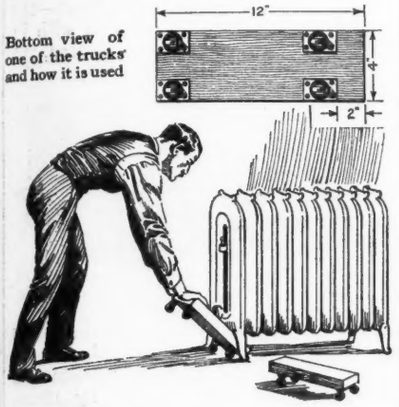
This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

The Home Workshop

Simply Made "Skates" Aid in Handling Heavy Radiators

AFTER my father strained his back moving a radiator, I devised the two small trucks or "skates" illustrated. Each one is made by screwing four casters on a wooden block, 2 by 4 by 12 in. One pair of casters is set back from the end about 2 in.; the other is even with the end.

In use, the overhanging end of the skate is placed under the end of the



Bottom view of one of the trucks and how it is used

radiator. By pressing down on the other end of the skate, the radiator is lifted sufficiently to allow the skate to slip under. With a skate under each end, the radiator can be wheeled easily.—R. B.

Sturdy Wooden Plant Stands

(*Continued from page 108*)

corners of both sides of these pieces so that the legs and nails may be placed accurately. The uprights are kept 1½ in. inside the edges. Two tenpenny nails are driven into each joint. The rubber tacks are driven into the base near the corners. The completed pieces are stained and waxed or stained and given a coat of flat varnish.

The material required for the second pair of pedestals is as follows:

2 boards 1 by 5¾ in. by 14 ft.
1 board 1 by 11 in. by 4 ft.
1 strip 1 by 1½ by 16 in.
A few sixpenny and tenpenny nails

The 14-ft. boards are cut into eight lengths of 37½ in. The ornamental holes are marked in the center of each piece, beginning 14 in. from the bottom and running to 11½ in. from the top. After boring the holes, cut out the ½-in. strip with a compass saw.

The four top and bottom pieces are 11 in. square. They are fastened to the sides 1 in. from the edges with four tenpenny nails at each joint. The eight feet are sawed from the 1 by 1½ in. strip and fastened at the corners of the bottom with two sixpenny nails in each joint.

Sandpaper the pieces before assembling, making the strokes lengthwise with the grain. The wood for the tops and bottoms should be planed before being sandpapered. After assembling, the edges are chamfered or rounded off.

The heads of the nails are set ⅛ in. deep and the indentations filled with putty that is colored with stain.—J. T. GARVER.

My Life Work

The finest shaving cream you will ever know

Let me send you a tube to try

By the Chief Chemist

GENTLEMEN:

In less than 4 years, Palmolive Shaving Cream has gained top place. Its success is a business sensation.

Will you do us the courtesy of trying it? Men literally are flocking to it.

We asked 1,000 men

Our first step was to ask 1,000 men what they most desired in a Shaving Cream. All of them agreed on four things.

But one requirement, and the greatest of all, is something no man mentioned. That is, strong bubbles which support the hairs for cutting.

We made 130 trials or tests

We made up 130 formulas which we discarded.

Then we attained, by many times over, the best Shaving Cream in existence. Today Palmolive Shaving Cream is winning men by the millions, as they try it.

Don't change from the cream you like now until you see what Palmolive Shaving Cream does. But make this test. Try ten shaves, and let the results show if we have excelled the rest.

5 New Delights

1—Multiplies itself in lather 250 times.
2—Softens the beard in one minute.
3—Maintains its creamy fullness 10 minutes on the face.
4—Strong bubbles hold the hairs erect for cutting.
5—Fine after-effects, due to palm and olive oil content.

To add the final touch to shaving luxury, we have created Palmolive After Shaving Talc —especially for men. Doesn't show. Leaves the skin smooth and fresh. Try the sample we are sending free with the tube of shaving cream. Clip coupon now.

THE PALMOLIVE COMPANY (Del. Corp.), Chicago, Ill.

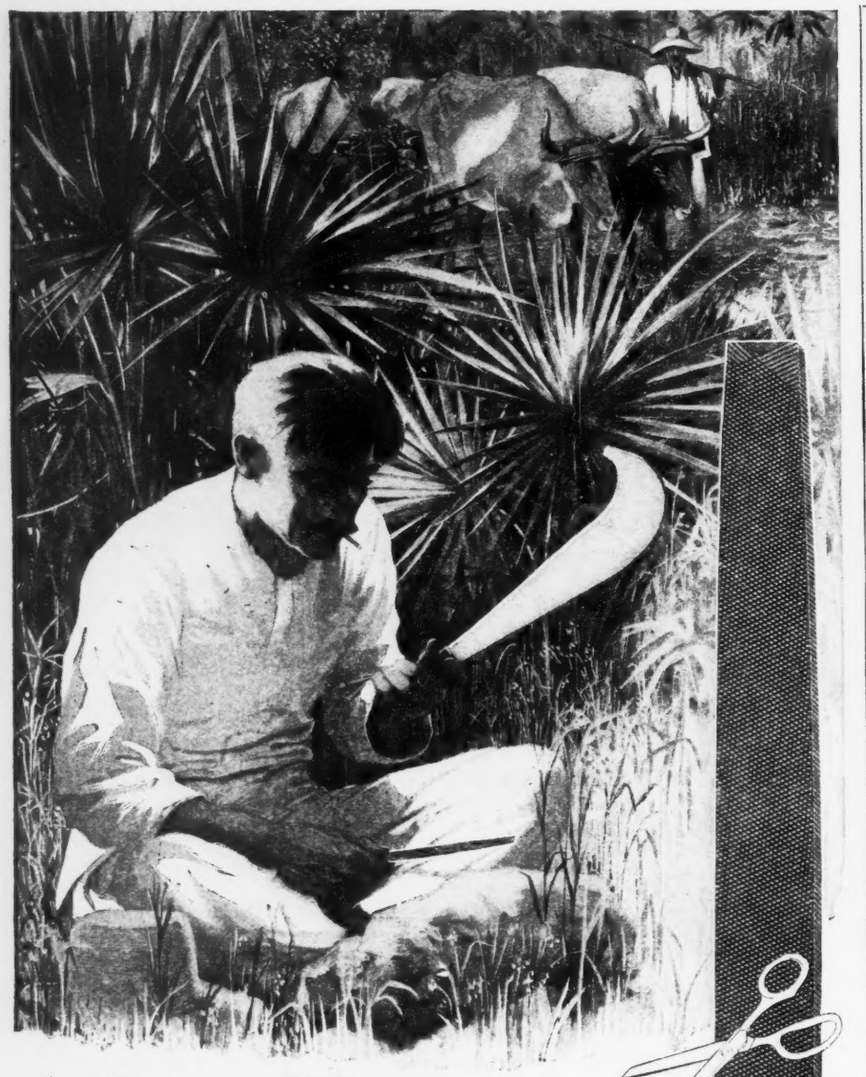
PALMOLIVE SHAVING CREAM

10 SHAVES FREE
and a can of Palmolive After Shaving Talc

Simply insert your name and address and mail to Dept. B 969. Address for residents of Wisconsin, The Palmolive Company (Wis. Corp.), Milwaukee, Wis. Address for residents other than Wisconsin, The Palmolive Company (Del. Corp.), 3702 Iron St., Chicago, Ill.

2735

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.



A Keener Edge···

For jungle undergrowth, sugar-cane ···perhaps even tropic politics···cutting tools must be razor sharp and shaped just so. It's the file that keeps them properly edged, adding impetus to even primitive industry.

From the gold mines of Alaska to rubber plantations on the Amazon···whetever tools need sharpening and files must render constant and faithful service···NICHOLSON FILES are preferred.

In your home, too, you can quickly sharpen every cutting edge with a NICHOLSON FILE···one of the many reasons why they belong in your tool equipment.

NICHOLSON FILE CO.
Providence, R. I., U. S. A.

NICHOLSON FILES
~a File for Every Purpose

The Home Workshop

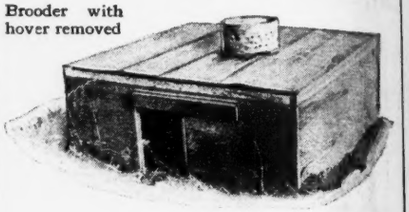
Fumeless Chicken Brooder Costs Little to Construct

By L. B. Robbins

WHILE there are many types of brooders for raising chicks, the one illustrated has been tried out with the greatest success for several seasons by the builder. It can be built for practically nothing and will raise easily from 50 to 60 chickens until they are six weeks old. It is used indoors.

Poisonous fumes from the lamp—the most dreaded thing to contend with in brooding—practically are eliminated, yet

Brooder with hover removed

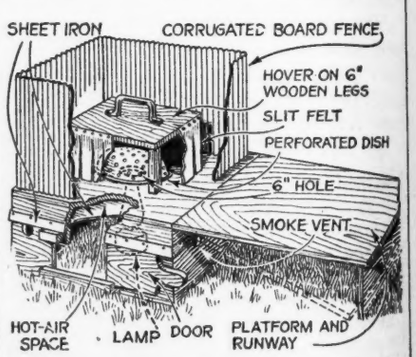


the heat is distributed so that the chicks can secure any degree of warmth.

The body of the brooder consists of a wooden frame 32 in. square by 12 in. wide. Across the top of this frame tack a piece of sheet zinc or iron and turn the edges down all around. A strip of sheet asbestos between the edges of the board and the metal will make a tight joint. This completes a strong, boxlike structure with an open bottom and a metal top.

Nail four pieces of 3-in. furring around the box and over the metal. Use long wire nails to go through the furring and the metal and into the frame. Then floor this second structure over with thin, matched (tongued-and-grooved) boards, making as tight joints as possible. This construction forms a 3-in. air space above the lower frame.

Cut a 6-in. hole in the center of the flooring and invert an old cooking dish



Heat from the lamp is transmitted through a metal diaphragm to a hot-air radiator

over it, fastening it to the floor with small brads. The dish should be punched full of small holes to radiate the warmth from the hot-air chamber.

A square hole is sawed in one side of the body of the brooder, as indicated, and fitted with a sliding door.

The hover consists of a thin wooden panel 24 in. square set on four wooden legs 6 in. high. Fit some sort of a handle

(*Continued on page 111*)

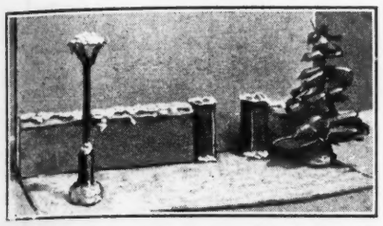
Ⓢ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

The Home Workshop

Sealing-Wax Aids in Making Toys and Models

SEALING-WAX is a useful medium for making interesting little toys as well as colorful models such as the one illustrated, which is an amateur theatrical scene, built on the scale of ½ in. to 1 ft.

The back drop is a piece of illustration board painted with water colors. The wall and gate are stiff drawing paper. The snow on the wall is white wax. By drawing the soft wax slowly off the edge and then cutting the threads with a scissors, realistic drifts and icicles are formed. The lamppost is a 20-penny nail standing on its head and covered with black and white wax.



Miniature scene for amateur theatricals made with sealing-wax on illustration board and paper

When the wax is soft it can be molded easily with the fingers or with small knife blades and large needles. Cylinders or spheres are formed by twirling the wax carefully over an alcohol flame. As the last step, a brilliant gloss can be given to the work by running it quickly through the flame.—KENNETH M. SWEZEY.

INSOLES for shoes may be cut from an old felt hat. They are fully as satisfactory as commercial insoles and cost nothing. If thoroughly washed, a piece of old felt hat makes a good rubbing felt for finishing woodwork. The felt also is useful for cutting gaskets.—W. L.

Fumeless Chicken Brooder

(*Continued from page 110*)

to the center of the top and tack a 6-in. strip of felt around the edges. Slit up the felt at intervals of 2 in., so that the chicks may pass in and out of the hover.

For heating use a regulation brooder lamp or a common lamp with short chimney. Light it and place it under in the center of the lowest compartment. Provide a few holes along the top edge of the wide frame, below the metal ceiling, to carry off the fumes. The air in the 3-in. space above then becomes heated without odor. The heat passes out of the holes in the heating drum and warms the interior of the hover. An average size flame will maintain 90 degrees in cold weather.

Corrugated board, tacked about the brooder as indicated, can be used to fence the young chicks in for the first few days and then extended as they increase in age and size. An extension platform can be hinged to the front to furnish the birds more floor space and finally let down to form an inclined runway when they are allowed to have an outside run.

This brooder may be cleaned readily, is safe, and will raise strong, healthy chicks.

WORTH WHILE TOOLS

THERE is satisfaction in the ability to tackle odd repair jobs about the home; and if one has the energy and determination to do some of this work himself, the savings in time and money will be considerable.

The kind of tools used often determines the quality of the work. To be sure of the best results, get the right tool for the purpose. There's a large variety of Pexto Tools made in all practical styles and sizes. You can't go wrong if you insist on these century-famous tools.

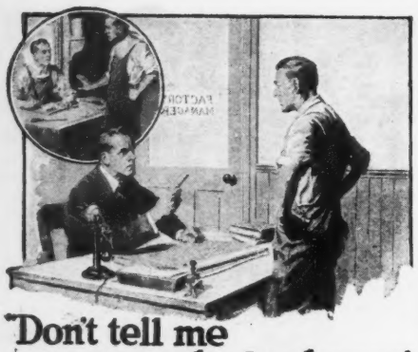
For the mechanic and for general home use, the Pexto Samson Ratchet Bit Brace, illustrated above, will give a lifetime of dependable service and stand up under the severest 'roughing.' Its ball-bearing chuck gives the Pexto Brace a grip that never lets go. It will hold round, square or taper-shank drills. The Samson is the kind for you—it's a boon to the "home mechanic."

All Pexto Tools are backed by a century of tool making experience. The line consists of Bit Braces, Hammers, Chisels, Screw Drivers, Hatchets, Snips, Squares, Wrenches, Pliers, Pruning Shears, and many other small tools. It is easy to procure Pexto Tools as they are carried by practically all progressive dealers. Booklets covering our lines are available for free distribution. Ask for them.

THE PECK, STOW & WILCOX CO.
SOUTHINGTON, CONN., U. S. A.

Ⓢ

PEXTO



Don't tell me you never had a chance!

"Four years ago you and I worked at the same bench. I realized that to get ahead I needed special training, and decided to let the International Correspondence Schools help me. I wanted you to do the same, but you said, 'Aw, forget it!' You had the same chance I had, but you turned it down. No, Jim, you can't expect more money until you've trained yourself to handle bigger work."

There are lots of "Jims" in the world—in stores, factories, offices, everywhere. Are *you* one of them? Wake up! Every time you see an I. C. S. coupon your chance is staring you in the face. Don't turn it down.

Right now over 180,000 men and women are preparing themselves for bigger jobs and better pay through I. C. S. courses.

You can join them and get in line for promotion. Mark and mail this coupon, and find out how.

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 7644-D, Scranton, Penna.

Without cost or obligation on my part, please tell me how I can qualify for the position or in the subject *before* which I have marked an X:

BUSINESS TRAINING COURSES

☐ Business Management
☐ Industrial Management
☐ Personnel Organization
☐ Traffic Management
☐ Business Law
☐ Banking and Banking Law
☐ Accountancy (including C.P.A.)
☐ Nicholson Cost Accounting
☐ Bookkeeping
☐ Private Secretary
☐ Spanish ☐ French
☐ Salesmanship
☐ Advertising
☐ Better Letters
☐ Show Card Lettering
☐ Stenography and Typing
☐ Business English
☐ Civil Service
☐ Railway Mail Clerk
☐ Common School Subjects
☐ High School Subjects
☐ Illustrating

TECHNICAL AND INDUSTRIAL COURSES

☐ Electrical Engineering
☐ Electric Lighting
☐ Mechanical Engineer
☐ Mechanical Draftsman
☐ Machine Shop Practice
☐ Railroad Positions
☐ Gas Engine Operating
☐ Civil Engineer
☐ Surveying and Mapping
☐ Metallurgy ☐ Mining
☐ Steam Engineering ☐ Radio
☐ Architect
☐ Architects' Blue Prints
☐ Contractor and Builder
☐ Architectural Draftsman
☐ Concrete Builder
☐ Structural Engineer
☐ Chemistry ☐ Pharmacy
☐ Automobile Work
☐ Airplane Engines
☐ Agriculture and Poultry
☐ Mathematics

Name.....
Street Address..... 3-6-24
City..... State.....
Occupation.....

Persons residing in Canada should send this coupon to the International Correspondence Schools Canadian, Limited. Montreal, Canada

Why Not Make $100 A WEEK? It's Easy this New Way!

Why slave along on a meagre income when you can make $75—$100 a week just wearing this beautiful Hand Tailored FREE RAINPROOF Cap? Just think—S. W. Allen of California made $40.80 in one day's joyful work!

$10 a Day in Spare Time

Hundreds of men are reporting profits of $10 a day in just their spare time. This cap is so superior to store caps that every man wants one. Every Taylor Cap is RAINPROOF—the moisture can't soak in. Choice of finest woolens and latest styles. No experience is needed. Get a cap for yourself FREE. Write at once for our FREE Selling Outfit. **TAYLOR CAP MANUFACTURERS, Dept. 9-D, Cincinnati, Ohio.**

The Home Workshop

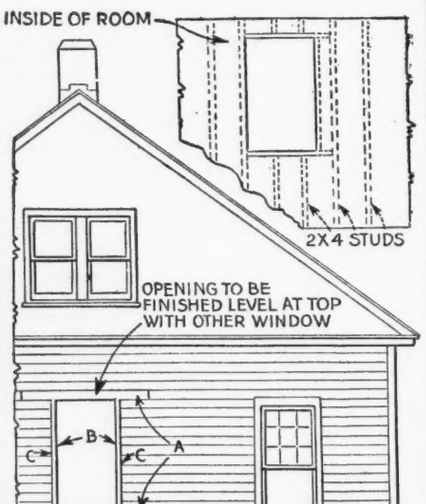
How to Cut a Window Opening in a Frame House

TO CUT a new window opening in a frame house presents no great obstacle to the skilful home worker.

The location for the window in the room is fixed by the individual circumstances in each case. It remains to be seen, however, if in that position it would injure the appearance of the residence from the outside. This may be judged by measuring from the outside corner of the house, allowing about 6 in. more than the distance across the room or rooms as measured inside.

Should there be a window above or below that comes almost in line with the place for the opening, keep the new window exactly in line, if possible, even if the location is not so desirable on the inside.

If the window is smaller in height than others on that side of the house, it is usually best to make the new window line up at the top with the others, as illustrated. This brings the window higher from the floor from the inside, but this is not unusual and often no disadvantage.



Inside and outside view of opening cut and ready for placing a new window frame

Before cutting the opening, tap the plastered wall to find the location of the studs or vertical members of the house frame. If by changing the position an inch or so, the cutting out of one side stud can be avoided, do this; it saves much time.

For double-hung sash, that is, the ordinary sliding sash with weights, mark the proposed opening on the wall 6½ in. wider and 5 in. higher than the sash size. For example, if the pair of sash are 2 ft. 6 in. by 5 ft., the opening should be 3 ft. ½ in. by 5 ft. 5 in. If casement sash without weights is used, the allowance in width need be only 2½ in. more than the sash.

Cut out the plaster on the lines with a chisel, breaking out a strip about an inch wide to expose the lath. Then cut through the lath with a coarse compass

(Continued on page 113)

Tried by a thousand trails

CARLETON CANOES are built to stand the gaff of years of the hardest service. They do it too. In over a quarter of a century of manufacture we have never had one dissatisfied user.

Carleton Canoes are wonderfully light. They are beautifully balanced, fast and surprisingly easy to handle. And Carleton Canoes are unusually reasonable in price.

Send for our new illustrated catalog. It gives prices and complete information. Write for your free copy today. THE CARLETON CANOE CO., 74 First Street, Old Town, Maine, U. S. A.

CARLETON CANOES

Protect Your Tools with - NYOIL

Your valuable tools can be protected absolutely from rust. Cover all your tools that you aren't using regularly with a thin coat of NYOIL. Keep a can in your tool chest. The patented cap prevents it from leaking. Remember—Summer is the worst season for rust.

NYOIL is a highly refined oil that does not color or stain or gum. Makes an excellent polish for pianos, automobile and other highly finished surfaces.

Buy Nyoil of your dealer or write us.

W. F. NYE, New Bedford, Mass.

Carrying Case **FREE** with Big **3 ft. Telescope**

See people and objects miles away just like they were close; see Moon and Stars as never before. Opens over 3 ft. long, 5 sections, brass bound, powerful lenses. Useful and entertaining. "Could color of aeroplane 4 miles away."—Mrs. Yarbough. "Watch my boy arrive at school 2 miles away."—Mrs. Horn. "Read numbers on freight cars mile away, see mountains on moon."—A. C. Palmer. Thousands pleased. **Send No Money!** Write today; on arrival of Big 3 ft. Wonder Telescope with FREE Carrying Case and Strap pay Postman only $1.85 plus a few pennies postage. Satisfaction Guaranteed.

FERRY & CO., 3224 W. Halsted St., Dept. 9784, CHICAGO

Delivered to you Free for 30 days trial on approval. Your choice of **44 Styles**, colors and sizes of the famous **Ranger** Bicycles. Express prepaid. Bicycles **$21.50** and up.

$5 a Month if desired. Many boys and girls easily make the bicycle earn the small monthly payments.

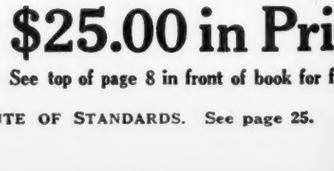
Tires wheels, lamps and equipment at half usual prices. Write for remarkable factory prices and marvelous offers.

Mead CYCLE COMPANY DEPT. A-250 CHICAGO

Write us today for free catalog

RADIO SETS — AUTO BODIES

SEND FOR THE INTERNATIONAL CATALOG



Our net price list. Full line of Radio Sets; and auto bodies for Fords at *Wholesale Prices*. Save big money by buying Direct from Factory.

International Body Works, 914 W. Ohio St., Dept. 6, Chicago, Ill.

$25.00 in Prices

See top of page 8 in front of book for full details

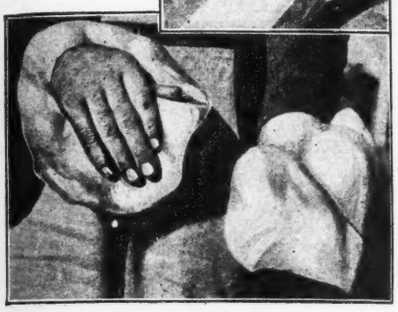
This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

The Home Workshop

Pads Protect Your Hands when Lifting Rough Objects

FOR rough, heavy lifting, nothing protects the hands better than the pads illustrated. They are made by cutting from an old inner tube two oval pieces, about the size of dinner plates. In one end of each is cut a slit long enough to admit a hand.

In use, the hands are thrust



through and the pads are pinched between thumbs and forefingers. Besides being inexpensive, they have the added virtue of not making the hands perspire as do gloves.—E. M. L.

How to Cut a Window Opening

(*Continued from page 112*)

saw. Also cut out the 2 by 4 in. studs that have to be removed.

You then are ready to work from the outside. Although at times this may be done from a ladder, it is a great advantage to rig up a scaffold opposite the opening to be cut.

It usually will be best to order the window frame, sash, and inside trim complete. When doing this, request that the outside casing be sent loose. The casing then will come tacked lightly to the frame.

Measure the frame with the casing on and mark the opening carefully on the beveled siding of the house with a straightedge and plumb.

In cutting the opening, the edge of the sheathing (*B*) should project about 2 in. beyond the edge of the siding (*C*) and a section of the siding (*A*) should be removed both at the top and bottom of the frame, to be replaced after the frame is set up. The drip cap on top of the frame should be covered with metal and painted before the upper piece of siding is put in place. At the bottom of the sill a groove will be found into which the bottom piece of the siding fits. Take care to nail the casing very solidly to the wall and frame.

WHEN boring holes in wood without a depth gage, it is possible to have all the holes the same depth by counting the number of turns taken for the first hole and using the same number of turns for all the others.—M. E. S.

SIMONDS CIRCULAR SAWS

WHEN you specify SIMONDS in ordering a solid tooth circular saw, or any other style of saw, you can be certain that its quality is protected not only by Simonds near-century of experience in making the finest cutting edges of tempered steel, but that constant laboratory tests and development work assure you that your selection represents the very last word in cutting tool manufacture.

No matter what your cutting problem may be, put it up to Simonds, either through your supply house or dealer or direct.

SIMONDS SAW AND STEEL COMPANY
Fitchburg, Mass.
"The Saw Makers" Established 1832
Branch Stores and Service Shops in Principal Cities

SIMONDS

Pronounced SI-MONDS

SAWS FILES KNIVES STEEL

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

If You Can Hum a Tune

Send for this New Offer

If you can hum a tune you can now learn to play a musical instrument quickly and easily. Think of the pleasure music will bring you. You are always popular and sure of a good time. And there is no easier way to earn money.

Learning to Play Made Easy

Free We now furnish **free** with every Wurlitzer instrument a Special Scholarship in a nationally famous school of music. This school has taught thousands to play by a special home study method. Many of its graduates are successful professional musicians. Whether you wish to play for pleasure or for profit, choose your favorite instrument and send for this New Offer now! Use the coupon below.

Free Trial—Easy Payments

You may have any Wurlitzer instrument for a week's free trial in your own home. No obligation to buy. Payments are arranged in small monthly sums — a few cents a day will pay for your instrument.

Send for Free Book

Illustrates and describes every known musical instrument — more than 3000 articles, many of them shown in full colors. Special offers on complete outfits. All genuine Wurlitzer instruments—buying direct from Wurlitzer saves you money. Wurlitzer instruments are the result of 200 years experience. Praised by masters in every sphere of music for artistic quality, rich tone and fine workmanship.

We also give you our Free Trial, Easy Payment plan and Free Scholarship offer. No obligation. Send coupon now.

WURLITZER

Cincinnati Chicago
New York San Francisco

Send this Coupon

The Rudolph Wurlitzer Co., Dept. 1784
117 E. 4th St. Cincinnati 329 S. Wabash Ave. Chicago
120 W. 42nd St. New York 250 Stockton St. San Francisco

Send me your Free Book on musical instruments. Also your Free Trial, Easy Payment plan and special Free Scholarship Offer. No obligation.

Name.....

Address.....

City..... State.....

Instrument.....

WURLITZER

Copyright 1925, Rudolph Wurlitzer Co.

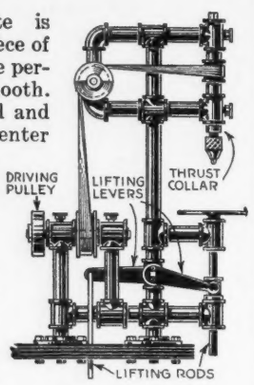
The Home Workshop

Bench Drill Press Made of Pipe and Fittings

ALTHOUGH made of common pipe fittings and pipe, the small bench drill press illustrated is capable of doing fast and accurate work.

The driving shaft is machined from a piece of cold rolled steel. A thrust collar is located at the chuck end and the end is turned to a Morse taper to suit the chuck to be used. The standard tees used as bearings are babbitted to suit the shaft and tapped where convenient to receive grease cups.

The faceplate is made from a piece of ½-in. steel plate perfectly flat and smooth. A hole is drilled and tapped in the center of plate to fit the end of the lifting rod. The rod is cold-rolled steel.



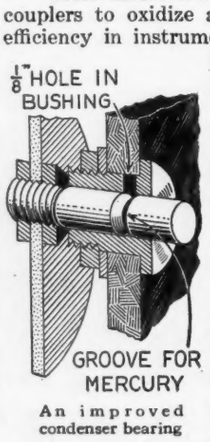
Details of simply made bench

The lever block in which the end of the lifting lever slides may be either round or square, with flanges on top and bottom. The lifting levers are made from pieces of ½-in. flat steel. A square hole in the levers engages a fulcrum shaft, which passes through a pipe cross. A rod is connected with the back lever and passes through a hole in the bench to a treadle underneath. This foot method of feeding the faceplate upward allows both hands to be free.

The pulleys are of cast iron. A selection of speeds can be obtained, of course, by using a pair of step pulleys.—F. N. C.

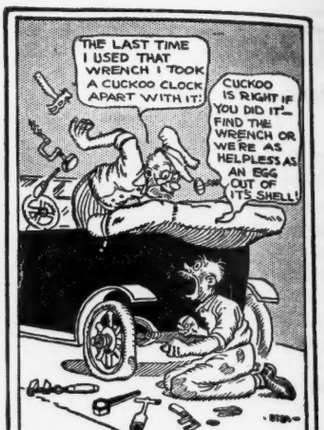
Mercury Improves Friction Contacts in Radio Parts

TO OVERCOME the tendency of the rotor shafts of radio condensers and couplers to oxidize and cause a loss of efficiency in instruments designed to use friction contacts instead of "pigtails," some radio fans who pride themselves upon their neat workmanship use mercury to insure good contacts. The method is illustrated.



An improved condenser bearing

A groove about 1/16 in. deep is filed around the shaft so that it will be inside the bushing when assembled. A ⅛-in. hole is drilled in the bushing to coincide with the groove. The shaft and bushing should be absolutely clean. When assembled, the groove is filled with mercury by means of a pipette or medicine dropper. This insures good conduction.—PHILIPPE A. JUDD, Portsmouth, Ohio.


THE LAST TIME I USED THAT WRENCH I TOOK A CUCKOO CLOCK APART WITH IT!
CUCKOO IS RIGHT IF YOU DID IT— FIND THE WRENCH OR WE'RE AS HELPLESS AS AN EGG OUT OF ITS SHELL!
HUNTING THROUGH THE SUPPLY OF TOOLS FOR A WRENCH THAT WILL FIT

It Looks Funny

—but it isn't—when you're far from help

VERY likely means an expensive tow-in job—which would cost a whole lot more than a selected Set of Snap-On Wrenches that would always be on hand to help you out of trouble.

Spring is in the air—the open road is calling. Play safe this season—go over your car and tighten up all the nuts and bolts before you start on a trip. It's a quick job with Snap-Ons. Take your Set with you and relieve that gnawing anxiety about road trouble. It will bring a new element of safety that will enhance the pleasure of motoring.

This selected Set for the Ford is equipped with a chart of great value to the owner in making repairs. *Ask us about the selected Set for your car.*

Snap-on
INTERCHANGEABLE
Socket Wrenches

Snap-Ons are the choice of over 250,000 garage mechanics. Look for the name—without it no wrench is a genuine Snap-On.

SNAP-ON WRENCH CO., MFRS.
Milwaukee, Wisconsin

Motor Tool Specialty Co.
Distributors 14 E. Jackson Blvd., Chicago
Send me particulars. My address is—

The Home Workshop

Spring Overhauling Lengthens Life of Your Heating Plant

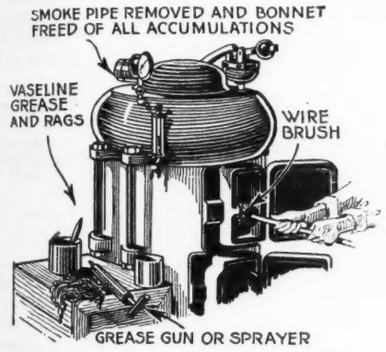
By Orion O. Oakes

Heating and Ventilating Engineer

AS SOON as fire is no longer needed in the spring, clean out thoroughly all flues and the upper portions of your steam-heating or hot-water boiler with a wire flue brush. Rub all surfaces well to remove soot, ashes, and scale. Part of this material will fall on the grates, part will be drawn out through the various cleanout doors, and part will lodge in the smoke bonnet.

When the flues and upper works are well cleaned, remove all the ashes from the ash pit and clean the pit. The smoke pipe should be removed and scraped with the flue brush, and the smoke bonnet, which now will be accessible, should be freed of all accumulations.

Next obtain a plant sprayer or oil gun and spray all the interior surfaces of the boiler with crude oil or light machine oil.



After being thoroughly cleaned, all metal surfaces are sprayed with oil or greased

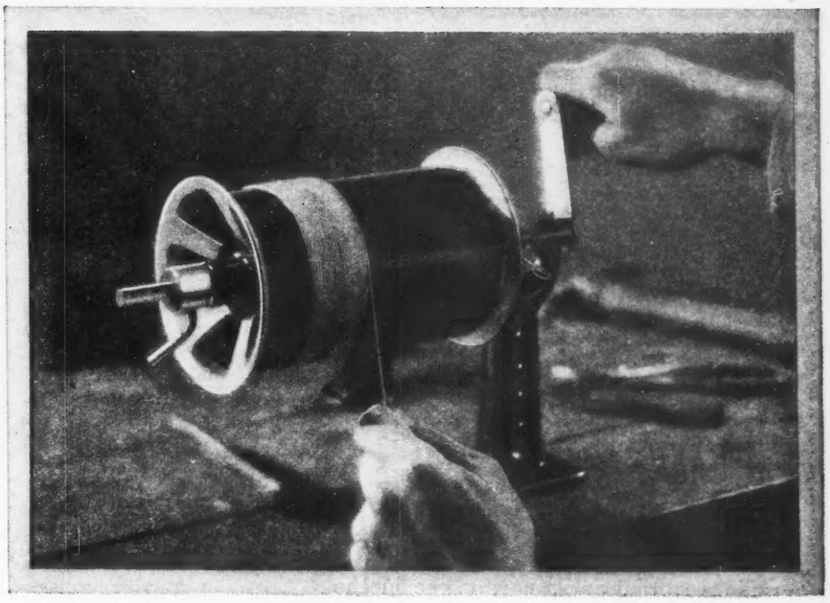
If convenient you may use oil taken from the crankcase of your automobile for this purpose. For the exterior portions use vaseline or a light grade of automobile grease applied with a rag.

The importance of this work is because all flue doors, fire doors, clinker doors, and cleanouts are ground on the edges at the factory to make contact with the frames. When these ground joints are unprotected during the summer, the moisture of the air forms sulphurous acid by combining with soot and this in turn acts on the cast-iron or steel surfaces with a corrosive action. When ready to be used in the fall the doors will be found coated with scale and the hinges and pins may be so affected that the close and accurate contact of the parts is destroyed. The condition becomes worse each succeeding year.

One of the most important requirements for efficient operation of a fire is that all door openings or joints of any kind fit tightly. It will be seen that ill fitting, corroded doors mean poor combustion and loss through fuel waste.

If the boiler is of the metal jacketed type, the entire outer surface should be coated with grease. Treat the smoke pipe in the same manner as the inside of boiler and store it in a dry place if possible.

(Continued on page 116)



A new tool that radio fans have been waiting for

NOW the radio amateur can "wind his own" as quickly and as expertly as any professional coil winder—and at one-tenth the cost. This Goodell-Pratt Coil Winder is a new tool made especially for winding tubular coils, inductance coils, and transformers for superdyne and neutrodyne circuits.

Holds any cylinder of cardboard, bakelite, or fibre up to 4¾ inches in diameter and 7 inches in length. The outer aluminum driving disc is adjusted to the cylinder length by a sliding collar, which can be locked at any point on the spindle with a thumb screw. The outside face of this collar is cut at an angle, affording a cam action against the button on the disc hub, which exerts a continual tightening effect on the cylinder. And because both discs are cone-shaped, the cylinder is centered automatically.

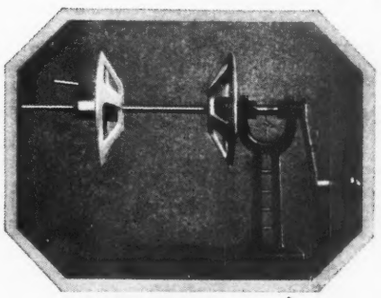
The spring wound around the spindle prevents it from turning backward and releasing the tension on the coil wire. If unwinding becomes necessary, merely raise the loop end of the spring.

Nicely finished in red and black enamel, and natural aluminum, with all exposed steel parts well polished. Length over all 14½ inches, weight 3 pounds.

Other tools for radio builders. Write for special radio tool folders, which show all the Goodell-Pratt radio tools, many of which are new and exclusive Goodell-Pratt inventions.

GOODELL-PRATT COMPANY, Greenfield, Mass., U. S. A.

Makers of Mr. Punch



No. 695 Coil Winder

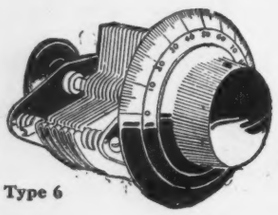
GOODELL-PRATT

1500 GOOD TOOLS

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

S-E-L-E-C-T-I-V-I-T-Y

To A New Degree



Type 6

A RESULT OF THE

IMPROVED MICROMETER DIAL

U. S. Tool Condensers

AGAIN in the van as a result of constant research and painstaking experimenting—U. S. Tool announces an improved micrometer dial, a boon to radio reception and a new degree in the selectivity of DX stations.

The separate knob turns the ENTIRE rotor slowly, accurately, too precisely to slip by any station within reach. Stations passed by on ordinary condensers are instantly detected with the micrometer dial. Factory-tested and guaranteed to be within 3%, plus or minus, of the indicated capacity.

FACTORY GUARANTEE

Write for Literature

U. S. TOOL COMPANY, INC.

127 Mechanic St. Newark, N. J.

Mfrs. of Special Tools, Dies, Jigs, Automatic Machinery and Sub Presses

New Elto Invention

by Ole Evinrude

The Propello Pump

Ends All Pump Troubles

There is not a single moving part in the new Elto Pump. Yet a flood of water flows constantly through the cooling system. It never fails. The rudder openings scoop up the water as the motor runs, straining it to keep out clogging materials. The whirling Propeller Blades push and force the water into circulation. Once started, the water siphons continuously.

Works Perfectly at all Speeds—and in all Waters

Slow down to a fish-getting trolling speed, or open up the throttle wide for a race; go anywhere in muddy or sandy water—fresh or salt. As long as your engine is running, you *know* the Propello Pump is working. No more sticking valves. No more clogging pipes. No more over-heated engines. No more expensive repairs.

Other Elto advantages are 50% More Power, Much More Speed, Least Weight per Horse Power, Instant Starting Every Time, Push Button Reverse, Safe Rudder Steering, Larger Bearings, Sturdier Working Parts, Longer Life. *Write for catalog.*

ELTO OUTBOARD MOTOR CO. Ole Evinrude, *President*
Dept. W, Manufacturers' Home Bldg. Milwaukee, Wis.
(22)

Found Only on Elto Ole Evinrude's New 3 H.P. Fast LIGHT TWIN

"The Motor that Starts with a Touch"

The Home Workshop

Overhauling a Heating Plant

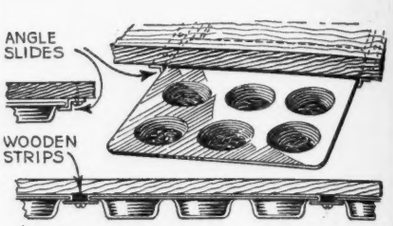
(*Continued from page 115*)

The boiler should be filled completely by adding water to that already in the boiler and not by emptying and refilling. The water in the boiler has been repeatedly distilled and therefore has less action during summer than new water.

Oil or grease all moving or wearing parts of the pressure regulator and cover, if desired, with an oily cloth to prevent the accumulation of dust through the summer. If there is a thermostat, wipe it and cover with a cloth.

Biscuit Pans as Receptacles for Small Hardware

ORDINARY 10-cent biscuit pans, painted black with screen enamel to prevent rust, are excellent containers for small hardware, such as screws, nuts, tire valves, and washers. The pans may be



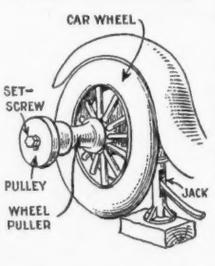
The biscuit pans slide on runners placed under the bench top or under any shelf

hung to the bottom of a shelf or bench on runners bent from 18-gage galvanized sheet iron, or made from ⅛ by 1 in. strips of band iron and ½-in. square wooden spacers. The runners should be screwed, not nailed, in place.—R. C. T.

A Large Glue Scraper Made from an Old Hand Saw

A PLAIN wood scraper about 4 by 10 in., made from an old saw, preferably a stiff one, is very handy in knocking off the hardened excess glue from joints preparatory to planing, scraping, and sandpapering large surfaces such as table and counter tops. It does not bruise the surface and is so large that ample elbow grease may be applied.—J. A. H.

Belt Pulley Fastened to Auto with Ordinary Wheel Puller



WISHING to use my automobile for power purposes, I fastened a pulley to a rear wheel by means of an ordinary wheel puller.

A wooden pulley was sawed out to the right size to give the speed desired. This was fastened to the wheel puller with the setscrew. I jacked up the rear end of the car, screwed the puller on the hub, turned the pulley to a smooth finish, and belted it to a saw.—S. H. S.

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

The Home Workshop

How to Re-Cane Chairs

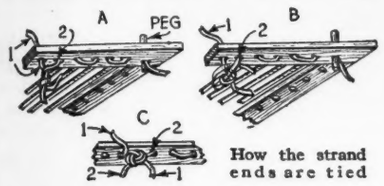
(Continued from page 96)

it in the groove. Then pour more thin, hot glue into the groove, making sure that the entire length is covered and that there is a surplus amount to be forced out as the spline is driven into place.

Take one end of the spline, which has been soaked previously in water to make it pliable, and drive it in at the center of the back rail. Tap it lightly all the way around until it meets in the back. Cut off the surplus with a saw or sharp chisel. While doing this, put a block under the end. Avoid scratching the chair.

With a narrow wedge or a small block of wood, drive the spline down into the groove all the way around until it is flush with the surface of the chair. Wash off the surplus glue carefully with hot water.

After the cane has dried thoroughly, which will take two or three days, it will be as tight as a drum head. If you have been careful to get an even tension on the surface when driving in the wedges, the surface will be entirely free from wrinkles or puckers. The chair now is ready for use, but to make sure that the cane will remain taut in various temperatures, it is well to give both lower and upper



How the strand ends are tied

surfaces several coats of good white shellac, after which varnish may be applied.

If the chair you are to cane has no spline and, therefore, has been woven by hand, a different procedure is necessary. The diagrams on the preceding page give the correct method to follow.

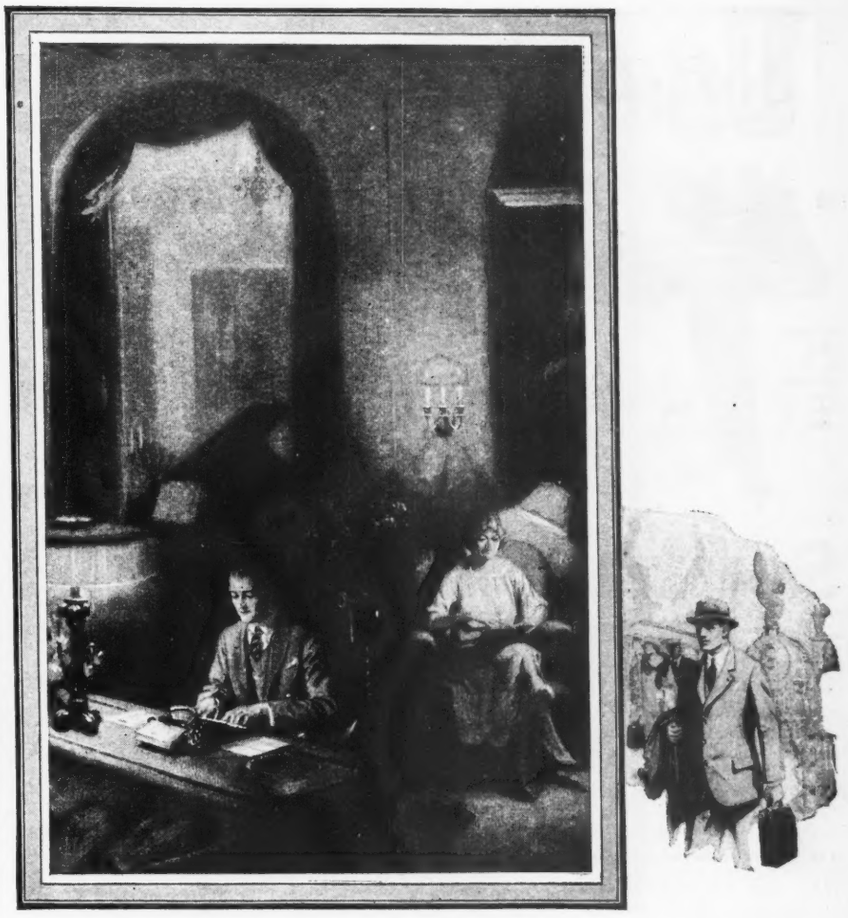
Cane for hand weaving may be purchased by the hank of 1000 ft., and comes in various sizes such as fine-fine, fine, medium and coarse. The medium size is used most. You will need about 300 ft. for one chair and about 5 ft. of binding cane.

After removing the old cane by running a sharp knife or chisel across the strands on the bottom and lifting it out from the top, clean up with soap and water and a good stiff brush.

All cane is moistened for not more than three minutes before using. While the diagram explains the steps in caning a square bottom, the method is the same regardless of the shape. If the chair is wider in the front than at the back, count the holes at both places. Say there are 17 in the back and 19 in the front; start your caning from the left rear hole and go to the second hole in the front. If there were 15 holes in the rear rail and 19 in front, you would begin in the left rear hole and go across to the third hole in the front rail. For circular seats the point to keep in mind is to have your cross strands parallel.

Referring to the diagram (page 116), run one end of the cane first through *A* about 2 in. and hold it with a peg. Run

(Continued on page 118)



In fairness to your family and yourself

OF course you want your family to enjoy all of the advantages of modern living. But, have you provided them with the modern way of writing?

Have you considered what a wonderful help a Remington Portable will be to that boy of yours, and what an invaluable training it will give him for his life's work—whatever it may be? Do you realize the many precious hours it will save for everybody in the home?

Wouldn't it be worth a great deal to you to have this always ready helper on hand to take care of your personal writing? Countless homes now find the Remington Portable indispensable, and we are sure that yours is no exception.

The Remington Portable is the choice of most people the world over, because it has every feature common to the big machines, is easy to operate, does beautiful work always, is compact, and carries its table on its back.

Sold everywhere. Easy payment terms, if desired. Write today for illustrated "For You, For Everybody."

We believe we make the best typewriter ribbon in the world —and its name is PARAGON

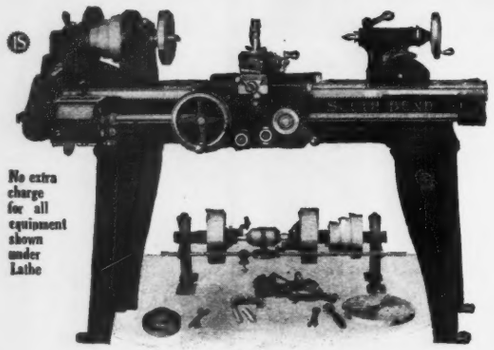
Address Department 67
REMINGTON TYPEWRITER COMPANY
374 Broadway, New York

Remington Portable

THE RECOGNIZED LEADER IN SALES AND POPULARITY

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

Use Your Lathe



No extra charge for all equipment shown under Lathe

While Paying for It

Now You Can

Get This

11 in. x 3½ ft.

Quick Change Gear

South Bend Screw Cutting Lathe

—for only $284. Easy Payments if Desired

Here is your chance to get a brand new, latest improved South Bend Lathe on convenient terms. We ship Lathe upon receipt of first payment, allow 30 days' trial, and you have the use of the Lathe while paying for it. In this way it helps earn its own cost. We make this liberal offer on any South Bend Lathe. 31,000 in use in U. S. and 64 Foreign Countries.

For example, in plants of 2 largest Steel Companies, 8 largest Auto Factories, 5 largest Railroad Shops, by U. S. Government, etc.

SOUTH BEND Lathes embody 32 major improvements made within the last 2 years. Unsurpassed in accuracy and efficiency.

SOUTH BEND LATHE WORKS,
317 East Madison St., South Bend, Ind.

Gentlemen: I would like to know your price and terms on a..... Lathe. Please send Free Catalog.

Name.....

Address.....

.....

CATALOG FREE! Write or send coupon today. Free Book shows 96 styles in all sizes, from small Bench Lathe to largest Factory Lathe. Compare our prices with what others ask, and remember every South Bend Lathe carries our liberal guarantee and 30 day trial offer. Send for Catalog today.

South Bend Lathe Works, 317 EAST MADISON STREET, SOUTH BEND, IND., U.S.A.

Easy to Draw Cartoons

When Shown in the RIGHT WAY

Some of the cleverest cartoonists and comic artists learned how to draw in their spare time by following **Cartoonist Evans' Simple and Easy to Learn Method** and are now MAKING GOOD MONEY. Send one of your drawings, and let Mr. Evans see if you have ability and receive the **Portfolio of Cartoons** and full details about the course. **It is not expensive.**

THE W. L. EVANS SCHOOL OF CARTOONING
825 Leader Building **Cleveland, Ohio**

NEW VEST POCKET ADDING MACHINE

Adds as rapidly and accurately as a $300 machine, yet fits the vest pocket. Mechanically perfect. Easy to operate—nothing to get out of order. Everyone who uses figures should own one.

$2.95

Counts Up to 999,999,999

Total visible at all times. A pull of the finger clears it. Don't carry a pocket full of pencil stubs and scrap paper to do your figuring. Carry a Ve-Po-Ad.

10 Days Trial Send no money. Just name and address and we will send machine postpaid. Pay postman on delivery $2.95. Use it for 10 days to prove it does all we claim. If not perfectly satisfied we will refund your money. Limited supply. Send order today. **Reliable Adding Mach. Corp., Dpt. 75, 170 W. Washington St., Chicago, Ill.**

AGENTS Here's a money maker. Everybody wants one. Splendid profit. Write for special offer.

LEARN RADIO

Become a big-pay man in the greatest industry of all time. Quickly, easily and right at home, you can fit yourself for highest salary positions, or you can cash in on your spare time. The call is urgent for mechanics, operators, designers, inspectors. Unlimited, fascinating opportunities on land or sea

I WILL TRAIN YOU AT HOME TO BE A RADIO EXPERT

Under my practical, easy to understand, instruction—you qualify in an amazingly short time. No previous experience is necessary. Every branch of radio becomes an open book to you. You learn how to design, construct, operate, repair, maintain and sell all forms of Radio apparatus. My methods are the latest and most modern in existence.

FREE Wonderful home construction tube receiving set of the latest design. **Write Today** "Radio Facts" **FREE**

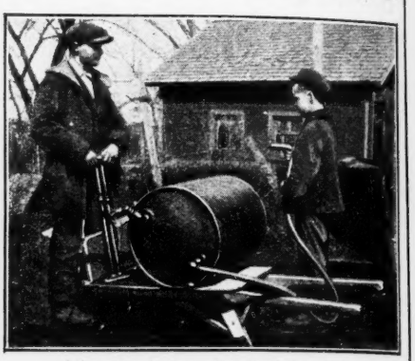
J. E. Mohaupt, Radio Engineer, RADIO ASSOCIATION OF AMERICA, Dept. 44, 4513 Ravenswood Ave., CHICAGO

The Home Workshop

Tank for Cheap Sprayer Made from Oil Drum

A STEEL drum such as may be had at low cost from almost any garage, can be made into an efficient sprayer tank for poultry yards, orchards, and gardens.

Pipe fittings with a hose and suitable shut-off nozzle are attached to one of the openings of the drum. Through the cap or plug of the other opening a hole is drilled to admit an auto tube stem. This stem is attached with suitable gaskets so as to be airtight.



A homemade spraying tank for use in the garden, orchard, or poultry yard

After the drum has been filled with the spraying mixture and placed on a flat wheelbarrow, so that it may be rolled occasionally to keep the mixture agitated, an auto tire pump is connected with it and used to obtain sufficient pressure for spraying.—GEORGE G. MCVICKER.

How to Re-Cane Chairs

(*Continued from page 117*)

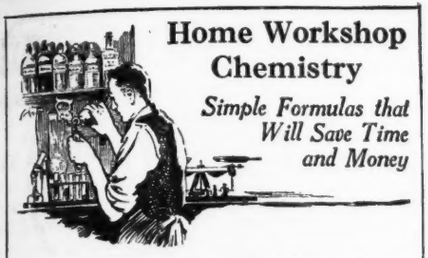
across and down through *B*, and hold with a second peg. Move the peg each time to insure tightness, but through the whole procedure do not strain.

The diagonals are woven in the fifth step. Start at *A* and run the strand under the strands woven in the first and third steps and over those of the second and fourth steps. Take great care to follow this order throughout. If the cane does not lie flat and straight, some mistake has been made. Be sure that the cane runs into the squares and not between two strands. Fasten one end (*LS*) by slipping it under one of the strands on the under side of the chair. Continue as shown, following the holes alphabetically.

In the seventh step lay the binding cane *X* over the holes and bring the medium cane *Y* up on one side and down on the other as shown. Keep the medium cane pulled very tightly and when you have gone completely around, tie down the loose end under the last loop.

If the reader of this article happens to be a boy who is anxious to earn a little money, he will find that almost every home in his neighborhood has a chair stored away somewhere that needs to be re-caned. A charge of $1 for putting in the machine-woven cane and $2 for the hand-woven will be a very reasonable price, yet, after he has gained experience, it will net a nice little sum in comparison to the labor expended.

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.



Home Workshop Chemistry

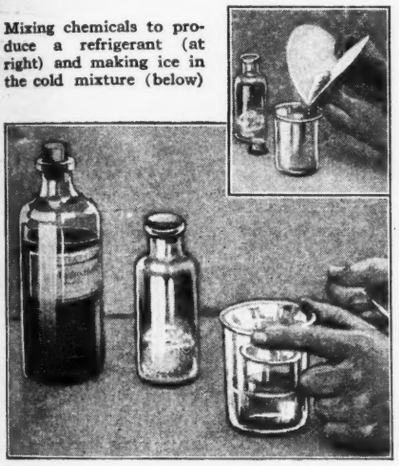
Simple Formulas that Will Save Time and Money

LOW temperature can be obtained easily through the use of relatively common chemicals.

Dissolving one part of sodium nitrate in an equal part of water, the quantities being taken by weight, will give an average drop of about 25° C. or 45° F.

Equal quantities of ammonium nitrate and water also can be used. The drop in temperature will vary from 50° F. to about 10° F.

A chemical reaction will serve the same purpose. Eight parts by weight of Glauber salts (sodium sulphate) are used



Mixing chemicals to produce a refrigerant (at right) and making ice in the cold mixture (below)

together with five parts by weight of dilute hydrochloric acid, made by pouring the acid slowly into an equal quantity of water and stirring it. Let the acid solution cool before pouring it into the container holding the crystals. A double decomposition takes place and ordinary salt, or sodium chloride is formed together with sulphuric acid.

By this method ice can be made on a small scale. Into a large container, preferably non-metal because of the acid, place the Glauber salts and add the dilute acid. Into a smaller and taller vessel place pure tap water and immerse the vessel in the freezing mixture. In from five to 10 minutes, ice will be formed. It can be used without danger, for the chemicals used in the freezing mixture do not come in contact with the water in the smaller vessel. Other uses for such freezing mixtures will suggest themselves.

Liquids that do not freeze readily also can be prepared. A saturated solution of table salt in water will remain fluid to approximately 0° F. or about 18 degrees below zero on the C. scale. This solution will not corrode or affect the metal parts of an engine. Equal parts of glycerine and water also can be used and it has the advantage of not crystallizing when the water evaporates. In both cases, when the water evaporates, just add pure water.

Now You Can Afford —
a modern precision-made set which "cuts through"

¶ Tuned radio frequency for distance and selectivity, reflex for economy, the wonderful loudspeaker tone quality and volume which comes with ALL-AMERICAN precision manufacture—all are present in this *non-radiating* three-tube receiver. ¶ And, owing to the economy of "wiring it yourself," ALL-AMAX SENIOR costs *less* than a *finished one-tube set* of equally high quality. ¶ *Take it home today* from your favorite radio store; wire it this evening, and "tour the country" before you retire for the night! **Price $42.**

All-Amax Sets come completely mounted on panel and baseboard with full instructions for wiring.

The **RADIO KEY BOOK** has, concentrated in its 48 pages, the answers to those questions you have been wondering about. It is a radio education in itself. Send 10 cents, coin or stamps, for your copy.

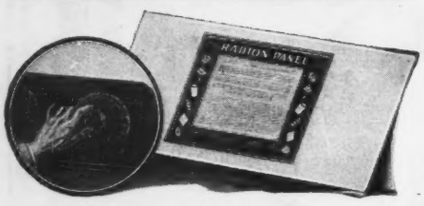
ALL-AMERICAN RADIO CORPORATION
PIONEERS IN THE INDUSTRY
2668 Coyne Street - - - Chicago

Other ALL-AMERICAN GUARANTEED RADIO PRODUCTS
There is now an ALL-AMERICAN Transformer for every radio need—Audio Frequency, Radio Frequency and Power Amplifying (Push-Pull) Transformers and Super-Fine Parts for Intermediate Frequency work.

All-Amax Junior

A one-tube reflex set that brings in the locals on the loudspeaker, with wonderfully clear tone quality, or tunes them out and gets real distance. *Non-Radiating.* Price $22.00

ALL-AMERICAN
Largest Selling Transformers in the World



"I selected it for its high insulating qualities

It cuts down the losses in the circuit"

THOSE were the exact words of a prize-winner in a radio set-building prize contest, when asked why he used a Radion Panel. Like thousands of others, he had found by experience that there is nothing quite like Radion for real results.

OUR engineers developed Radion Panels especially *to order* for radio. Losses from surface leakage and dielectric absorption are exceptionally low. And low losses mean clearer reception, more volume and more distance.

Easy to work—moisture proof—resists warping

RADION is easy to cut, drill and saw. You need not have the slightest fear of chipping. Radion resists warping. It's strong. It's moisture proof. It comes in eighteen stock sizes and two kinds, black and mahoganite.

RADIO dealers have the exact size you want. The use of Radion by the manufacturers of ready-built sets is almost invariably a sign of general good quality in that set.

Send for booklet, "Building Your Own Set"

OUR new booklet, "Building Your Own Set," giving wiring diagrams, front and rear views, showing new set with slanting panel, sets with the new Radion built-in horn, lists of parts and directions for building the most popular circuits—mailed for ten cents.

AMERICAN HARD RUBBER CO.
Dept. F4, 11 Mercer St., New York City
Chicago Office: Conway Building
Pacific Coast Agent: Goodyear Rubber Company, San Francisco, Portland

RADION
The Supreme Insulation
Ⓢ PANELS
Dials, Sockets, Binding Post Panels, etc.

AMERICAN HARD RUBBER CO.
Dept. F4, 11 Mercer St., New York City
Please send me your new booklet "Building Your Own Set" for which I enclose 10 cents (stamps or coin).

Name.....

Address.....

The Home Workshop

Giving Wings to Your Speedster

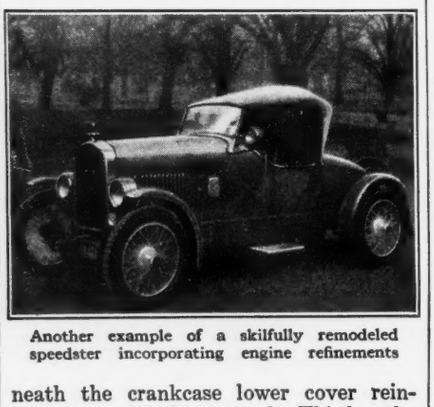
(Continued from page 83)

vided. The advantage in removing the magnets and coils lies in reducing the weight about 35 lbs., eliminating the drag of the magnets through the crankcase oil reservoir, and avoiding the magnetic pull.

The brass spools or spacers should be retained on the flywheel so as to splash the oil, unless some additional form of lubrication is added.

The engine flywheel and crankshaft should be balanced accurately on knife edges after these alterations are made. There are several types of supplemental oil-circulating systems from which to choose in order to improve the circulation and insure having sufficient oil in the trough for high speeds. These systems frequently are attached to the engine sump or to the petcock holes in the reservoir. They are connected with a small plunger type of oil pump, driven by the camshaft, which forces the oil to the forward part of the engine.

Another method that has met with considerable success is to shim under-



Another example of a skilfully remodeled speedster incorporating engine refinements

neath the crankcase lower cover reinforcement with sheet metal. This has the effect of increasing the depth of oil in the troughs. Care should be used, however, to see that the large ends of the connecting rods do not strike.

In connection with this method, it is possible to use a ⅜-in. oil-supply tube and to substitute a larger intake funnel adjacent to the flywheel.

To insure an adequate supply of oil for long runs, a desirable arrangement is to place a 1-gal. oil tank in the rear of the car. Connect this with a hand pump within reach of the driver and run a small copper pipe from the pump into the side of the breather pipe of the engine. The oil can be replenished at any time with a few strokes of the plunger.

The grade of lubricant is important. Only the best grade engine oil of high heat resistance should be used. Castor oil is recognized as a dependable lubricant for high temperatures.

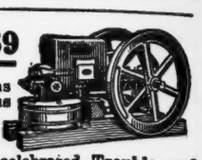
As long as a car is driven at moderate speeds, the thermosiphon cooling system is satisfactory. It is too sluggish, however, to combat the increased heat of high-speed operation.

Many water-cooling systems are sold. These are engine-driven and increase the circulation as the speed increases. They

(Continued on page 121)

Positively identified by the Ace trade mark stamped on the frame. A few strokes through the discs will sharpen the dullest knife. Try your hardware dealer first or send $1.00 direct to
ACE HARDWARE MFG. CORP.
Philadelphia Chicago San Francisco

Only $5.69 a month for a few months—easy to own the famous standard WITTE Engine. Uses Kerosene, Gasoline, Distillate or Gas. Equipped with celebrated Troubleproof WICO Magneto. Simplest and cheapest to operate. New device makes starting easy. 50% surplus power. Sizes 2 to 25 H-P—all styles. Sold direct from factory to you on NINETY DAYS' FREE TRIAL. Write today for my new illustrated engine book—sent absolutely Free. No obligation to you.



FREE BIG NEW ENGINE BOOK

WITTE ENGINE WORKS
2228 Witte Building, - - - KANSAS CITY, MO.
2228 Empire Building, - - - PITTSBURGH, PA.
2228 Witte Building, - SAN FRANCISCO, CALIF.

DON'T WEAR A TRUSS

BE COMFORTABLE—Wear the Brooks Appliance, the modern scientific invention which gives rupture sufferers immediate relief. It has no obnoxious springs or pads. Automatic Air Cushions bind and draw together the broken parts. No salves or plasters. Durable. Cheap. Sent on trial to prove its worth. Beware of imitations. Look for trade-mark bearing portrait and signature of C. E. Brooks which appears on every Appliance. None other genuine. Full information and booklet sent free in plain, sealed envelope.

MR. C. E. BROOKS

BROOKS APPLIANCE CO., 230-A State St., Marshall, Mich.

PLAY AT ONCE OR SEND IT BACK!

No knowledge of music necessary. No lessons. No practice. JAZZ CLARINETTE has sweet jazzy tone. Fine for dances, parties, entertainments. Special Offer: 87 Songs—jazz, old-time favorites—FREE with each order. (Regular price of songs alone $9.00.) Played by young and old.

87 SONGS FREE

Real musical instrument; not a toy. 15 in. long. Don't send a penny—just name and address. On arrival of Clarinette and 87 free songs deposit with postman our bargain price of only $2.48 plus few pennies postage. Satisfaction Guaranteed or deposit money returned. Big musical Catalog free with each order. Send today!

SEND NO MONEY

FERRY & CO.
Dept. 1784, Chicago

Anyone CAN LEARN!

No talent or experience necessary. Fascinating work. Pays big money. Complete instruction book TELLS ABOUT: Alphabets, Colors, HOW TO MIX PAINTS, Show Cards, Window Board and Wall Signs, Ready made letters, Gilding, TRICKS OF THE TRADE, also gives 100 Alphabets and Designs. Book bound in flexible lmt. leather, gold edges, and four ball bearing Show Card Pens. Book and Pens sent postpaid for $3.00. (C. O. D. 10c extra.)

OgilviePub.Co.,57RoseSt.,Dept. 72,NewYork

EARN MONEY IMMEDIATELY—WE FURNISH EQUIPMENT TO START

BEAUTIFY YOUR CAR!

Promanco
Auto Frames all the rage! Adjustable. Add 100% to appearance of any car. Order today. Postpaid $3.00. Money returned if not satisfied. Distributors. Fortune right men! Demand spreading like wildfire! Exclusive territory now. Write dept. 13.

PRODUCTS MANUFACTURING CORP.
168 DARTMOUTH ST., BOSTON, MASS.

Ⓢ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

The Home Workshop

Giving Wings to Your Speedster

(*Continued from page 120*)

connect either with the inlet or outlet water connections and are gear or belt driven from the fanshaft or the camshaft.

In the selection of a water pump, care should be taken to obtain one that may be fastened securely at several places to the cylinder block and can be relied upon to stay rigid. This is important, especially in regard to the propeller shaft at the packing gland.

With the engine speed in the neighborhood of 2000 r.p.m., the weight of the pistons and connecting rods becomes an important factor. Unless the engine is to be fitted with special aluminum or alloy pistons and light-weight connecting rods, the methods of weight reduction illustrated in the drawings on page 83 should be applied.

Summary of Alterations that Will Improve Your Speedster

IGNITION—Substitute single-spark system or high-tension magneto

LUBRICATION—Increase oil-trough supply and add auxiliary oil pump

COOLING—Use pump system for circulation

PISTONS—Use alloy pistons, or lighten cast-iron pistons by drilling

CONNECTING RODS—Drill out webs of the original connecting rods

CRANKSHAFT BALANCE—Pistons and connecting rods must be uniformly drilled to maintain equal weight. Balance flywheel exactly, after removing magnets

VALVES—Substitute tractor valves ¼ in. larger in diameter

EXHAUST MUFFLER—Remove present muffler and install straight tubular exhaust

WHEELS—Wire wheels are recommended for flexibility; they also reduce overheating of tires

GEARS—Three-to-one, or 2¾-to-one gears in differential permit of higher car speed, without excessive engine speed

LUBRICANT—Only best grades of oil, with high viscosity and flash point, to be used

The weight of the piston is reduced by drilling a series of ⅜-in. holes between the second and bottom ring and also below the bottom ring. In these locations the holes do not noticeably impair the strength of the pistons and are effective in reducing weight and improving the lubrication.

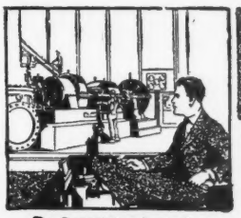
The connecting rod is lightened in the same manner. The smallest hole is 5/16 in. in diameter; the other holes increase gradually to ½ in. They are drilled through the web of the rod.

To improve the lubrication at the big end bearing, it is advisable to drill two ⅛-in. holes into the bearing from above. These conduct a portion of the draining oil on the rod to the bearing.

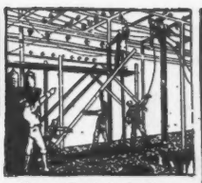
It is essential that each piston and connecting rod be exactly alike in weight so as to insure balance.

Overhead valve attachments are obtainable for use on the Ford engine. These unquestionably increase the power. It is

(*Continued on page 122*)


Be Superintendent of an Electrical Power Plant

Own your own Electrical Repair Shop, Electric Fixture, Supply or Appliance Store


Boss Electrical Construction Jobs

Be an Electrical Contractor

I Guarantee You a 50% Raise!

After you finish my Training!

If you're now earning less than $40 a week enroll for my home-training in Electricity and I will guarantee under bond in writing to find you a position at 50% raise in pay within sixty days after you finish, or I will refund every penny of your money. Mine is the only home-study Electrical School to make this guarantee.

Chief Engineer Dunlap

22 Electrical Engineers

This is not a one-man, one idea school. 22 famous Engineers and Executives of the following corporations and universities helped me make Dunlap-training the most complete and up-to-date:

General Elec. Co.
Commonwealth Edison Co.
Crocker-Wheeler
Cutler-Hammer Mfg. Co.
American Tel. & Telegraph Co.
Westinghouse Electric & Mfg. Co.
Western Elec. Co.
Underwriters Laboratories, Inc.
Columbia University
Dartmouth College
Massachusetts Institute of Technology
University of Vermont
Armour Inst. of Technology
And Many Others

$60 to $200 a Week!

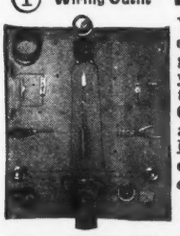
Enormous demand for all-around Electrical Experts as Power Plant Superintendents, Chief Electricians, Foremen of Construction, Electrical Draftsmen, Radio Engineers, etc. And with my training you can go into business for yourself with little capital and make $3000 to $12000 a year.

GO INTO ELECTRICITY — the Business of a Million Opportunities

While you're at it, while you're spending your time and money to be a success, *Train* for the big-pay *Boss* jobs in the world's fastest growing industry. The world's work is now being done by Electric power. Autos, ships, buildings, aeroplanes, all electric equipped. Electric lights, everywhere. Think of Radio, Telephones, Telegraph, Electric railways. This business DOUBLED in the last 9 years, and they say it will double again in the next 6 years!

I give you these 4 Electrical Outfits!

① Wiring Outfit



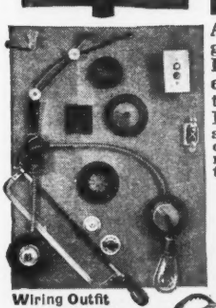
You don't have to leave your home or quit your job, you don't need post-graduate Laboratory courses when you are Dunlap-trained. I send you these 4 costly, complete Electrical Outfits, all the Laboratory and Shop apparatus you need to understand Electrical laws, theories and principles easily and quickly. *Not one penny extra for this equipment.*

Earn While Learning

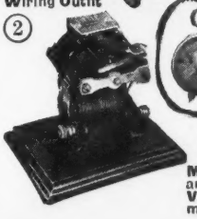
As early as your eleventh lesson, I give you special training in wiring, Radio, Electrical repairing, motors, etc, so you can go out and start turning your instruction into cash. It's no trick to earn enough in a single evening to pay one month's tuition cost. So you needn't let lack of ready money **or anything else** keep you from this wonderful home-training.

Mail Coupon at Once

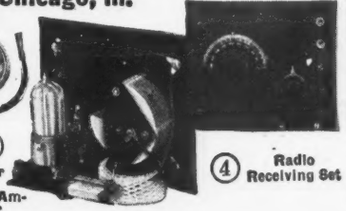
I have a surprise offer for you! Coupon brings complete information, free catalog, my sensational guarantee of a 50% raise, and my confidential surprise offer. *Mail it right away!*



Wiring Outfit

② 

③
Motor and Volt Ammeter



④ Radio Receiving Set

Chief Engineer Dunlap AMERICAN SCHOOL
Dept. E-475, Drexel Ave., and 58th St. Chicago, Ill.

JOB and RAISE COUPON

Chief Engineer Dunlap, AMERICAN SCHOOL, Dept. E-475 Drexel Ave. & 58th St., Chicago

Send me at once complete informtion about becoming an Electrical Expert, also guarantee of job and 50% raise, also your confidential SURPRISE offer.

Name_____

St. No._____

City_____

State_____

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

It's a Race Not a Run!

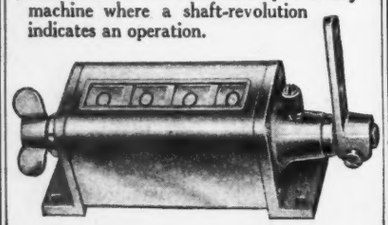
TODAY'S machines make a *race* of production, not a run. From the new design, new speed-gains; new time-savings.

How many pieces per minute will it add to the best records yet? Stop-watch and counter give the answer!

How to feed in material—speed out the product—still *faster?* Your experiments, your improvements will tell, and tell *exactly* in the production-records on a

Veeder

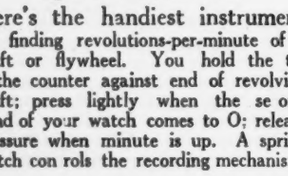
The large Revolution Set-Back Counter below records the output of any machine where a shaft-revolution indicates an operation.



Sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figure-wheels, as illustrated, $10.00—subject to discount. *Cut less than one-half size.* Set-Back Rotary Ratchet Counter, to record reciprocating movements as on presses, $11.50 (list). Smaller counters from $2.00 up.

Speed Counter

Here's the handiest instrument for finding revolutions-per-minute of a shaft or flywheel. You hold the tip of the counter against end of revolving shaft; press lightly when the second hand of your watch comes to 0; release pressure when minute is up. A spring clutch controls the recording mechanism.



(Cut less than ½ size.)

The Veeder Speed Counter enables you to keep motors, engines, generators, line shafting and machines operating at **efficient speeds.** Price, with two rubber tips (as illustrated) $3.50.

FREE—The 80-page Veeder booklet of counters for all machines and development-work

The Veeder Mfg. Co.
44 Sargeant St., Hartford, Conn.

The Home Workshop

Giving Wings to Your Speedster

(Continued from page 121)

possible to improve the engine, however, without this expenditure. Ford-tractor valves can be used in the ports, increasing the valve diameter ¼ in. This amount must be removed from the valve ports; that is, the diameter must be increased ¼ in. For this purpose it is sometimes possible to use a sharp valve-seat reamer, grinding down the reamer to obtain the size. It is obvious that these valves must be ground to a perfect seat.

The back pressure caused by the use of a muffler decreases the engine power and is to be avoided. One successful method of accomplishing this is illustrated. For open road work the cap is removed.

Wire wheels are recommended as representing the most desirable change from the wooden spoke type. These wheels have elasticity and exceptional strength. The heat generated by the tires, especially on hot days, is radiated more readily by these wheels and the tire temperature is kept down.

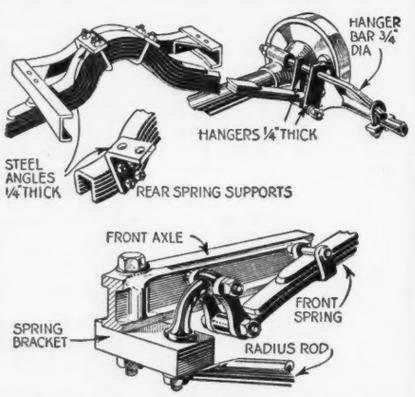
It is advisable to change the drive pinion and ring gear in the differential either to the ratio of 3 to 1 or to the ratio of 2¾ to 1. It hardly pays to make these gears, as they are obtainable at a reasonable cost.

These engine changes are not expensive or difficult to make. They are merely a matter of knowing what to do. The changes suggested embody the result of long experience in making fast cars faster.

A tabulation of the alterations under different headings is given elsewhere to aid you in selecting improvements you wish to adopt and in preparing a list of purchases to be made before undertaking the work of adding speed to your speedster.

Underslinging a Ford Speedster to Obtain a Racy Appearance

MANY amateur mechanics who have converted their light cars to the speedster type by the removal of the regulation body and the installation of



How the front and rear springs are lowered without making any elaborate alterations

bucket-type seats, large gasoline tank, and rear tool-carrier, are disappointed in the general appearance. The elevated frame seems top heavy.

To lower the frame 2 or 3 in. insures a

(Continued on page 123)

The only belt with the Patented Comfort Feature, which combines absolute comfort, perfect trousers support, and prevents curling and binding at the sides.

BRAXTON THE BELT FOR MEN

Handsome Jewelry Buckles. Many beautiful leathers and finishes. At all the best dealers.

The Perkins-Campbell Co.
New York Cincinnati Chicago

The Very Latest **Radio Book** **Free**

This Book Full of Radio Bargains.

Shows Big Savings on parts, sets and accessories.

Our prices are lowest on highest quality standard goods.

Send for your copy today

HOOK-UPS FREE Many New Circuits

The Barawik Co.
Dept. 201, 40 So. Clinton St., Chicago

Stop Using a Truss

Reduced Fac-Simile Gold Medal

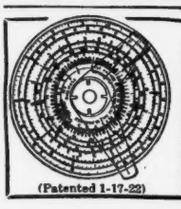
STUART'S PLAPAO-PADS are different from the truss, being mechanico-chemico applicators made **self-adhesive** purposely to hold the distended muscles securely in place. **No straps, buckles or springs attached**—cannot slip, so **cannot** chafe or press against the pubic bone. Thousands have successfully treated themselves at home without hindrance from work—most obstinate cases conquered. **Soft as velvet—easy to apply—inexpensive.** Awarded Gold Medal and Grand Prix. Process of recovery is natural, so afterwards no further use for trusses. We prove it by sending Trial of Plapao absolutely **FREE** Write name on Coupon and send TODAY.

Reduced Fac-Simile Grand Prix

Plapao Co., 790 Stuart Bldg., St. Louis, Mo.
Name.....
Address.....
Return mail will bring Free Trial Plapao

BLANK CARTRIDGE PISTOL
Protection against Burglars, Tramps, & Dogs
PRICES 50c & $1.00 POST-PAID

Well made and effective; modelled on latest type of Revolver; **appearance** alone is enough to scare a burglar. When loaded it may be as effective as a real revolver without danger to life. It takes standard .22 Cal. Blank Cartridges obtainable everywhere. **Price 50c. Superior quality $1.00 Postpaid. Blank Cartridges, by express, 50c per 100.**
Johnson Smith & Co., Dept. 331, Racine, Wis.



(Patented 1-17-22)

The Midget *"Five-in-One"* Slide Rule is a combination Mannheim, Polymetric, Log-Log, Binary, Add and Subtract Slide Rule. It will instantly add, subtract, multiply and divide any combination of whole numbers, fractions, mixed numbers and decimals. Gives every root and power, also Logs, Sines and Tangents. Made of aluminum with scales on white celluloid. Size 4 in. Approved and adopted by colleges. Price with Instructions, $1.50. Leather Case 50c extra. Sent C.O.D. if desired. Catalogue Free. **GILSON SLIDE RULE CO., Niles, Mich.**

The Home Workshop

Underslinging a Ford Speedster

(*Continued from page 122*)

racier appearance, steadies the car, and allows the wheels to hug the road when making turns at high speeds. In the accompanying illustration a method of accomplishing all this is shown.

The supports for lowering the rear spring are made from ¼-in. plate, rectangular in shape and drilled each end. A rod at each side passes through the plates. One end of the rod is fastened to the regular spring hanger; the other extends to the radius rod, where it is held as shown.

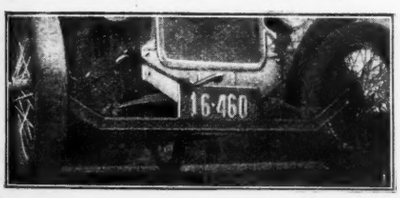
When the spring is placed in the lower position, it is necessary to use angle plates as a support in the center.

The lowering at the front of the frame is accomplished by moving the axle forward and making a bracket of rectangular section, with two holes drilled through each, to support the spring. The forward hole of each bracket is engaged by a bolt through the axle where the spring perch previously was located. The rear hole is used for fastening the spring perch above the bracket and the radius rod below the bracket as detailed.

The moving of the front axle forward also lengthens the wheel base. This is desirable, as it increases the steadiness with which the car holds the road.

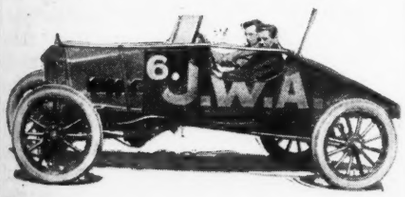
In fitting the forward bracket, the builder should make the upstanding lip, shown on the bracket, bear against the axle. This is to insure perfect lateral rigidity of the front axle. Inexpensive front radius rod braces are obtainable, their use depending upon the distance the spring is moved to the rear.

Reforging Front Axle Lowers Car's Center of Gravity



ONE ingenious amateur mechanic who was converting his light car into a speedster, lowered the center of gravity several inches by having the front axle reforged as shown. This was accomplished without altering any essential details or the steering method.

Remodeled "Flivver" Does 94 Miles an Hour on Beach



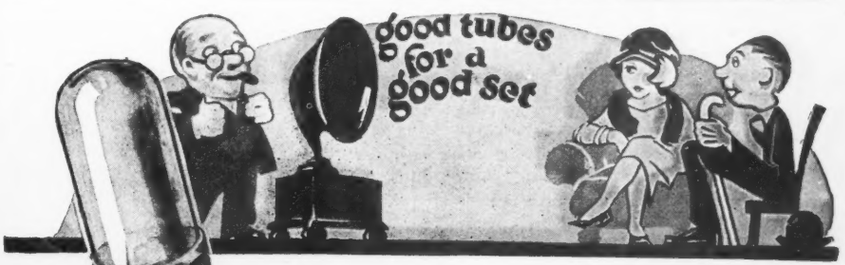
WHAT a remodeled Ford can do was shown when this car ran at 94 miles an hour on Muriwai Beach, New Zealand. It is owned by Stanley and Ivan Andrew, of Auckland.

Sure I'll Fix It!

NOTHING could be simpler with these Klein Pliers. Fact is, I'm glad to get my hands on them again. I guess every man feels that way about good tools.

Yes sir, most men *do* feel that way. That's one reason why Klein Pliers have been the favorites for 68 years. You'll notice that most hardware stores feature them. Electrical companies *specify* them! Treat yourself to a pair today.

Mathias KLEIN & Sons Established 1857 Chicago Ill USA



DID you ever look the tube question square in the face? Ever stop to realize that the vacuum tube will make or break your receiving set as far as good results are concerned?

Give your set a fair chance to bring in the distant programs. Resolve now that a good set deserves good tubes and decide on MAGNATRONS. The results will pleasantly surprise you.

MAGNATRONS know no superiors. And yet the MAGNATRON DC-201A, the MAGNATRON DC-199, and the MAGNATRON DC-199 with large base sell for only $3 each, at your dealer's.

Connewey Electric Laboratories
New York, N. Y.—Manufacturers

MAGNATRONS

We've mapped the air for Radio explorers!

Get your copy of this great new map to-day

TWIST the dials until you catch a faint hum. Nurse it carefully and it becomes a murmur of distant music. Then a moment of silence. "This is station KFAF, Denver"—and you add another station to your list.

But how far away was it? What sort of country did the message flash over? You want to visualize your exploit and mark it for future reference.

You can—with the New Collier Radio Map of the United States and Canada. It's beautifully printed in three colors. Every station is clearly marked and the time zones outlined.

Instantly you can tell how many miles away a station is. Cut out the scale of miles provided and paste it on cardboard. Put a pin through one end at the point where you are located. Swing the other end across the country until you reach the station you are after.

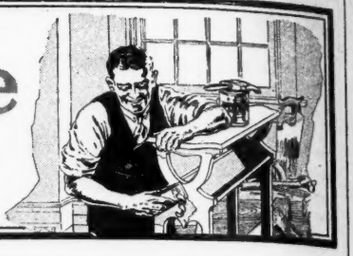
Here are some more points worth noting:

1. If you use a directional aerial, you can pick out any station you want to get on the map, and point the loop towards the exact point where the station is located.
2. Around the map there is an alphabetical list of all stations which also gives the name of the operator of each. If you miss the letters given by an announcer, you often catch the name of the operator of a station which can then be located by referring to the index.
3. The map outlines the boundaries of the radio districts, identifying them by number. This will be a help in locating amateur stations.

There's a lot of satisfaction in radio exploring with this great new map. And it costs only a quarter. Get your copy at your newsstand, bookstore or radio dealer's *tonight*. Or just mail 25c in coin or stamps with your name and address to us direct.

P. F. COLLIER & SON CO.
Dept. R.M. 250 Park Avenue
NEW YORK CITY

The Shipshape Home



Repairing a Porch Column

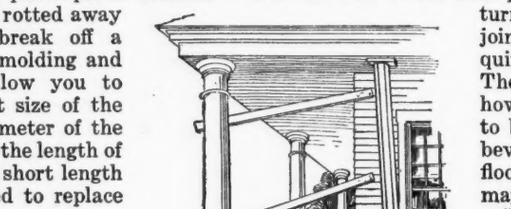
THE high cost of lumber has led to the use of much wood for the exterior woodwork of modern houses that does not last very well. For that reason the home worker often finds it necessary to repair porch steps as described last month, or even to patch porch columns.

If a column has rotted away at the bottom, break off a piece of the base molding and base block to allow you to measure the exact size of the block and the diameter of the column. Also find the length of the new base and short length of column required to replace the decayed portion.

Have a woodturner make the new section of the column unless you yourself have access to a lathe large enough for the work. Be careful to have it made a trifle larger rather than smaller than the old. If it should be smaller, a neat repair could not be made, but if it is a trifle larger, it is easy to pare and sandpaper the joint down and make a workmanlike job.

It will be necessary to prop up the porch roof with a strut, as illustrated, to take the weight off the column. One or two braces may be nailed from the house to the column to keep it plumb when it is being cut.

Measure exactly the combined height of the base block and short length of column and mark where the old column is to be cut. Nail on the column two strips to guide the saw, as shown; they must be quite level. If your saw is sharp and fine and the end of the new piece of post is turned true, the joint should require no fitting. The base block, however, will have to be fitted to the bevel of the porch floor, although this may be but a trifle.



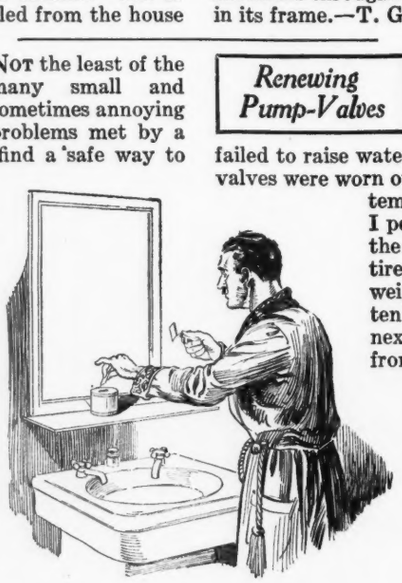
Sawing out the decayed base of a porch column before inserting a new piece

Repair the porch floor under the column, if decayed, and paint all joints before putting the new work in place. Only a few wire finishing nails are required to hold the new base in place.—A. E. E.

WHEN a stone or sharpening steel is not at hand, a knife may be brought to a keen edge by drawing it over the back or upper edge of a hacksaw. The hacksaw blade, which should be of the common type that is hardened throughout, must be held taut in its frame.—T. G. L.

Holder for Razor Blades

NOT the least of the many small and sometimes annoying problems met by a busy housewife is to find a safe way to dispose of used razor blades. She dare not throw them away, for bare little feet may find them. From bitter experience I found it unsafe to put them in the trash to be burned.



Nearly at my wits' end, I finally thought of cutting a slit large enough to admit a blade in the top of a used evaporated-milk can. The sharp edges are turned in and the can is enameled white. Once inside, the blades are beyond causing an accident. —MARGARET CRAGO, Louisville, Ky.

Renewing Pump-Valves

FIVE years ago a pump used in connection with a rather deep cistern failed to raise water. I found the leather valves were worn out. Having to make a temporary repair at once, I peeled three layers from the inside of an old auto tire, placed them under a weight overnight to flatten them out, and the next morning made valves from them. They are doing service yet. The service they have given already is more than might be expected from the best quality of leather valves, so that this type of repair can be recommended, especially as pumps often give out at a time when it is impossible to wait for regular valves. —F. X. ALLEN, Del Rio, Tex.

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

The Shipshape Home

Table-Leaf Closet

ONE great aid in keeping a home shipshape is a convenient place to store away the extra leaf or leaves for the dining-room table. A closet for this purpose usually can be built into the wall in the kitchen entry, hallway, or elsewhere.

To make such a closet, find out by tapping the plaster or wallboard where two

of the studs or upright supports are located and then cut out the wall between them from the baseboard up to a height 1 in. more than the length of the table leaves. Make a rectangular box to fit the opening, using ¾-in. sides and ends and a sheet of iron or tin for the back. Nail this in place in the opening and finish either with trim to match the other woodwork in the room, or with any small molding that is at hand or can be obtained easily.

The table leaves are held in place in the cupboard by dropping a rod with two down-turned ends into screweyes placed in each side of the cupboard.—T. F. WAIT, Storm Lake, Ia.

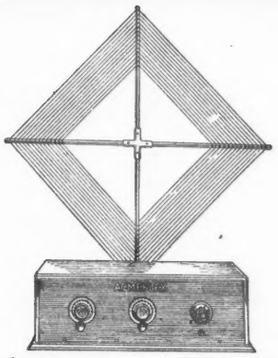
Paste for Stopping Leaks

A PUTTY-LIKE mixture of oxide of iron, coal tar, and boiled linseed oil may be used in repairing leaky gutters, water tanks, iceboxes, and the like. Several layers of cloth strips coated with this mixture make a good emergency substitute for a soldered sheet-metal patch.

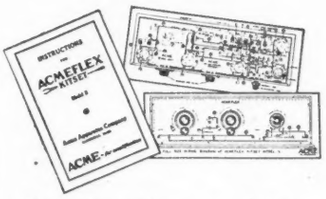
Dollars for Ideas

IN KEEPING your home shipshape, you often hit upon ingenious, time-saving, labor-saving and money-saving ideas.

If you will describe, in not more than 200 words, each of your ingenious keeping-the-home-shipshape methods, we will pay $2 for every one published. Include a pencil sketch or photograph to illustrate the idea, if possible, and address your letter to the Home Workshop Editor, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York.

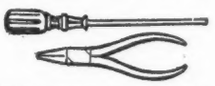


A set anyone can put together and enjoy all-the-year-'round radio



Directions given so simply that anyone can follow them

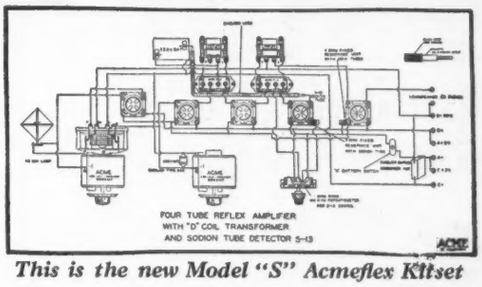
ABOVE are illustrated the circular of printed instructions and the life-size diagrams of the wiring, which are packed with each Model "S" Kitset. Step by step the making of the set is described in clear, simple language—just simple operations which anyone can easily follow.



Only two tools required—a screwdriver and pliers—and they are included in the Kit.

Enthusiastic praise from Model "S" user

From Hartford, Conn.:
"Just finished it tonight. It's a wonder. Finest we ever heard. Congratulations for your wonderful engineering."



This is the new Model "S" Acmeflex Kitset

IN THE above wiring diagram special attention is called to the D-Coil radio frequency tuning unit and the vacuum tube detector, giving the famous Acme Reflex (trademark) still greater distance, greater selectivity and better reception.

We can save you about $60.00

on this $150.00 radio

IF YOU bought this set completely assembled it would cost you $150. But by putting it together yourself you can buy it for only $80, plus cabinet, saving about $60. We could make it for less but it wouldn't give results.

Acme Engineers have done all the engineering for you and have written clear, simple directions which show you, step by step, how to put the set together. Many have done it in three hours, and found it fascinating fun. Even if you know nothing about radio you can put it together. All the parts are in the kitset, even the loop. No antenna to erect. Even a screwdriver and pair of pliers, the only tools you need, are included. No soldering to do. The panel is all drilled for you. The only accessories to buy are tubes, batteries, loudspeaker and cabinet.

And your finished set is the famous Acme Reflex (trademark) now wonderfully improved in distance, selectivity and reception. It will pull in distant stations loud and clear on a loop and loud speaker. Compare results with other sets of six to eight tubes. Only one tuning dial—easy to tune. Send coupon today for complete information. Lots of amateurs have built up a nice business putting together these sets for their friends.

Note these features of Model "S" Acmeflex Kitset

Complete directions given for putting set together. No antenna to erect. No technical knowledge or workshop required. Only two tools and they are in the kit. No soldering to do. Only one tuning dial. Excellent reproduction. Greater distance, sensitivity and selectivity. Non-radiating—won't bother your neighbor. Saves you about $60.00.

ACME APPARATUS COMPANY,
Dept. P-1, Cambridge, Mass.
Pioneer Radio and Transformer Engineers and Manufacturers

ACME
~ for amplification

Ⓢ

ACME APPARATUS COMPANY
Dept. P-1, Cambridge, Mass.
Send complete information about the new Model "S" Acmeflex Kitset to:

Name.....
Street.....
City.....*State*.....

10 DAYS FREE TRIAL - MONEY BACK IF NOT SATISFIED

THE NEW IMPROVED INKOGRAPH SELF FILLER
GREATEST VALUE EVER OFFERED

ACTUAL SIZE 6½in LONG
AGENTS WANTED

The Perfect Writing Instrument $1.50

Writes with ink free and easy as a lead pencil, without a miss, skip or blur. Its steady uniform flow of ink actually improves your hand writing. Won't blot, scratch, leak, or soil hands.

Makes 3 or 4 Carbon Copies With Original in Ink.
Anyone can write with your Inkograph, no style of writing or pressure can bend, spread, injure or distort its 14 kt. gold point.

The Writing HEMISPHERE

Patent Automatic 14 kt. gold feed prevents clogging. Made of best grade, highly polished, hard rubber, highest class workmanship. Pocket clip attached makes it an instrument of refinement.

The INKOGRAPH ACCOMPLISHMENT

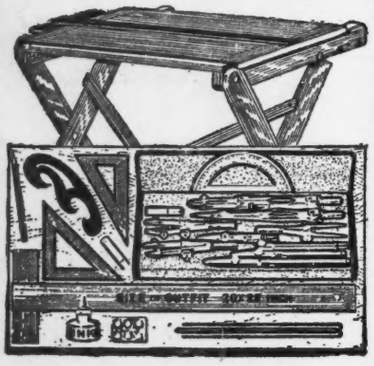
That hard smooth round ball like point, which glides with ease over the coarsest paper and makes possible writing in ink as rapidly as with the softest lead pencil.

You'll never use a fountain pen once you try an Inkograph. No complicated mechanism to clean or get out of order. SEND NO MONEY. Pay postman $1.50 plus postage. Year's guarantee certificate assures absolute satisfaction. Write name and address plainly.

INKOGRAPH CO., Inc. 163-7 Centre St., New York

Ⓢ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

All These Included No Extra Charge



Mail Coupon Below

Complete Set of Drawing Instruments sent as soon as you enroll. You get a 20x25 inch drawing board, a 24-inch T square, a 12-inch rule, a supply of drawing paper, two triangles, a French curve, pencils, erasers and thumb tacks. They would cost approximately $23.00 at any retail store but I include them in my course without extra charge.

The Trained Draftsman Earns a Good Salary

There is always a demand for skilled draftsmen. Companies are issuing calls every day for men to fill positions paying good salaries. Work is light, pleasant and profitable; a trained draftsman can be reasonably sure of having a good job all the time.

Chief Draftsman Dobe

I Guarantee

to train you on practical work under personal supervision until competent as a regular draftsman, and guarantee, further, to furnish you with draftsman's complete working outfit, a special "Chief's Own" drafting table, and all the instruments you need, just as soon as you become my student—all to be included in the course without extra charge.

Practical Training *Good Salaries*

I am a practical Chief Draftsman. I have been doing drafting work for a quarter of a century and I know just the kind of training that is demanded from men who get big salaries. I train you by giving you actual, practical work, the kind you must be able to do to hold a permanent position.

You May Earn a $90 Drafting Course

In addition to my other offers, I have made arrangements whereby you may earn a regular $90 drafting course while you are my student. I want to do everything possible to prepare draftsmen for the urgent calls now being made for them, by offering every inducement to ambitious men anxious to succeed in a big way. Big companies issue calls every day for skilled draftsmen to fill good paying positions. A trained man can be reasonably sure of a good job all the time. He can supplement his salary by extremely well paying home work. Write for details.

Chief Draftsman Dobe, Div. 13-64
1951 Lawrence Ave., Chicago, Illinois

Without any obligation on me whatsoever, please mail your book, "Successful Draftsmanship" and full particulars of your liberal "Personal Instruction" offer to a few students. Book is to be sent free and prepaid.

Name..... Age.....

Address.....

Post Office..... State.....

Better Shop Methods

(*Continued from page 88*)

Using an Electric Drill in a Planer

A portable tool is clamped to the clapper block to do the work of a big radial drill

By William G. J. Thompson

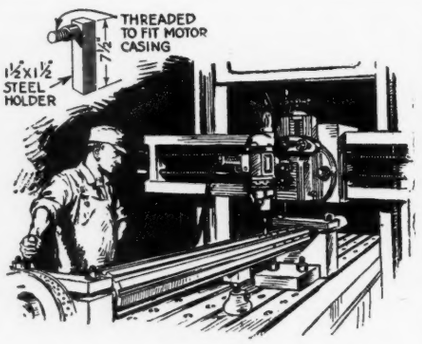
RECENTLY in the shop where I am employed, a 1200-lb. cast-iron roll about 6 in. in diameter and 10 ft. 6 in. long, had to be drilled. It had 11 grooves, in each of which 15 holes were to be drilled and tapped. If a radial drill and chain block had been available, this might not have been much of a problem, but all the regular drill presses were in such a position that a chain block could not be hung in a convenient place to take the weight of the casting.

The foreman was about ready to use one of the drill presses and about 6 or 8 men to move the roll, when I thought of adapting a big planer as a drill press.

Getting an electric drill from the tool crib, I found that I could unscrew one of the handles and make a holder for the drill that could be clamped in the planer. The foreman, when he heard my suggestion, told me to do whatever was necessary.

I obtained a piece of 1½-in.-square stock 9 in. long, and had the blacksmith bend it to form a right angle, one leg 7½ in. long and the other leg 1½ in. I centered the short end and turned and threaded it to fit the tapped hole in the drill motor casing. Then I screwed the holder into the casing and, finding it was not in line with the drill, I squared off the shoulder of the holder until it was exactly parallel to the motor.

After clamping it to the clapper block of the planer, I found that when the drill was fed into the work, the clapper block would swing out because the drill was ahead of the center of the clapper box. To overcome this difficulty, I locked the clapper block in the clapper box by drilling a hole in the clapper box and tapping it for a setscrew. I spotted the clapper block with the drill point to allow the setscrew point to hold firmly.



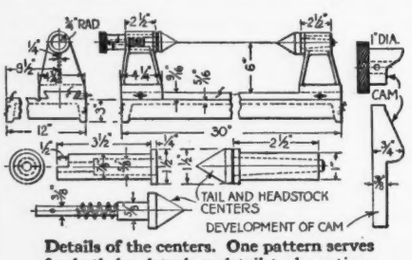
Drilling a large grooved roll with a portable electric drill fastened in a planer

Then I set the drill up and shimmed it until it was perfectly straight both ways. I locked the clapper block with the setscrew and moved the planer until the first hole was in line with the point of the drill. After drilling this hole, I indexed the next groove and drilled the second hole, continuing until the first row of holes had been drilled around the roll. Then I moved to the second row of holes and did likewise until the entire 165 holes were drilled. The saving of time and money was considerably over any other method that might have been used.

Bench Testing Centers

THE bench centers shown below are designed for use in the toolroom for laying out and testing work. The tool can be made at small expense.

The base is of cast iron and the centers are of tool steel, hardened and ground.



Details of the centers. One pattern serves for both headstock and tailstock castings

One pattern will do for both the headstock and tailstock castings.

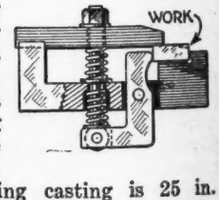
The slideway runs the entire length of the base. The tailstock and headstock, each of which is provided with a gib, can be set quickly any distance apart and held with thumbscrews.

All of the machine work should be done carefully, and for very accurate work the top surface of the base should be scraped. Both centers should be exactly the same height and precisely parallel with the slide and top of base.

A cam withdraws the tail center from the work with a half turn to the right. A coilspring returns the center to its position with another half turn of the knurled handle.

Double-Acting Machine Clamp

FOR machining a large number of straight edges ⅞ by 1¾ by 24 in., the writer had a double-acting clamping fixture made as shown.



The work-holding casting is 25 in. long, provided with one clamp at the center and two others about 3 in. from each end. Much hard work in setting and blocking up often can be saved by the use of a clamp of this kind.—F. N. C.

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

Better Shop Methods

Old Bill Says—

SOME of our customers will spend $100 repairing an old machine that is worth only $10 as junk.

What economy is there in repairing a worn or broken part or replacing an old machine that can be replaced by a new one for the same or, as often happens, less cost?

Old Bill, machine-shop foreman

Be sure to use a handle on a file when filing in a lathe.

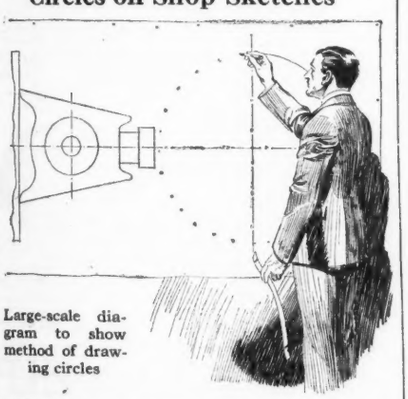
To be a good mechanic requires a constant struggle against slipshod methods, but half the battle is to have plenty of enthusiasm for work.

Vinegar is a wonderful help in loosening a rusted screw.

When you knock your shop, you knock yourself. If things never are going to suit you, why not get out?

When using a toolpost grinder, always protect the ways and bearings from grit by spreading an old newspaper or cloth under the wheel.

How to Draw Accurate Freehand Circles on Shop Sketches



Large-scale diagram to show method of drawing circles

EVEN experienced draftsmen often make sadly misshaped circles on their freehand sketches. They are especially apt to do so when they go into the shop to draw details, because usually they have not their drafting instruments.

Circles can be drawn quite easily, however, without any other aids than the sketch pad and the pencil. Tear off a strip of paper a little longer than the radius of the circle and on it check two points to limit the center and circumference to be drawn. Hold one point on the center and mark several points at intervals around the circumference as shown. With these guides the circle can be filled in accurately.—FRANK W. BENTLEY.

BARBERING
Now One of the Highest Paid Professions!

$90 to $150 Every Week!

BE A "WHITE-COLLAR" MAN—
Earn $90 to $150 a Week—CLEAN Money!

What's the use of doing dirty, greasy, *hard* work, when you can *NOW* make TWICE as much money in a manly profession that is CLEAN, profitable and full of opportunities?

Easy to Learn—Quick to Earn!

That's BARBERING for YOU! And the *best* part of it all is this—scientific barbering, as taught the modern MOLER way, makes YOU a Master Barber in a *short* course of *intensive training, at small expense!* You soon step out as your *own* Boss, if you wish, in your *own* Shop, which we will gladly help you equip.

See the World, Too!

Or, if you prefer, we will help you step into a *real* job, with *good* pay the *first* day, *after* you graduate. Ocean Liners, crack trans-continental passenger trains, big luxurious hotels and skyscrapers all over the world, as well as *thousands* of Barber Shops *ever where*, demand MOLER trained men.

MOLER Graduates Are Always Busy!

MOLER trained Men are always given the preference, for they *alone* possess the valuable, *thorough* MOLER training in the application of all the *latest scientific Barbering methods*, including the Electric hair cutter, the mechanical massage, and the latest vogues in ladies' hair bobbing. MOLER also gives special training in ladies' marcelling and an easy practical course in the treatment of skin diseases.

Earn While Learning!

"Where there's a Will there's a Way" to earn BIG pay! Write to the nearest MOLER College, *there is one near you*, and learn how you can *earn* while you learn the barber trade. Ask for the new FREE MOLER Barbering Booklet C. Find out HOW MOLER helps you help yourself AFTER you graduate, as well as BEFORE! Find out why MOLER Men are making DOUBLE the money others made last year, before Ladies' Shingle Bobbing became so popular. You're NEXT in line for big pay—the MOLER way. Send Coupon TODAY!

THIS?
"The XXth Century," "Oriental Limited" and other crack trans-continental trains carry barbers.
and THIS!
The Majestic, Leviathan, and U. S. Shipping Lines all carry barbers.

MOLER SYSTEM OF COLLEGES
30 Branches in United States and Canada

New York, N. Y.	Cleveland, Ohio	Atlanta, Ga.
Chicago, Ill.	Detroit, Mich.	Memphis, Tenn.
St. Louis, Mo.	Denver, Colo.	Dallas, Tex.
Kansas City, Mo.	Omaha, Nebr.	Houston, Tex.
Cincinnati, Ohio.	Milwaukee, Wis.	San Antonio, Tex.
	New Orleans, La.	

MOLER SYSTEM OF COLLEGES
Address Nearest Branch
(Street Address NOT Needed)

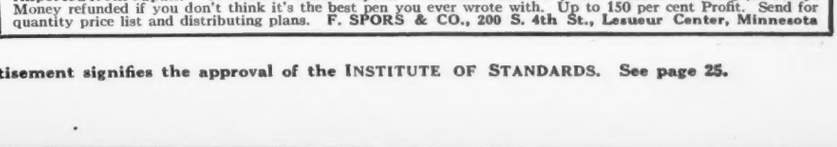
Please send me without obligation on my part your Booklet C.

Name.....
Address.....
City..... State.....

$25.00 in PRIZES

See top of page 8 in front of book for details

Sells for $1.25. Agent's Sample 65c.! *New Self-Filling Bamboo Fountain Pen with Stylo Point*


SCREW CAP ABSOLUTELY NON-LEAKABLE
PEN RETAINER FITS INTO BARREL FRICTION-TIGHT PREVENTING TWISTING OF TUBE
ITS THE POINT.
HAS EIGHT GROOVES FOR INK TO FEED

Imported from Japan. "It makes Carbon Copies." Guaranteed for 1 year. Hustlers Making $20 Daily! Money refunded if you don't think it's the best pen you ever wrote with. Up to 150 per cent Profit. Send for quantity price list and distributing plans. F. SPORS & CO., 200 S. 4th St., Lesueur Center, Minnesota

The pipe-tobacco case is closed for Mr. G. E. M.

An open mind is all very well—up to a certain point. But there comes a time when a man tires of experimenting with tobaccos. Particularly, it seems, if he has once known the pipe satisfaction of "good old Edgeworth."

So G. E. M., as he writes, has reached the stage where he is willing to let others do the experimenting while he sticks to his tried and true favorite.

Here is his deposition:

Larus & Brother Co.,
Richmond, Va.
Gentlemen:

After reading some of the letters in the different magazines, written by Edgeworth boosters, I have decided to sing a few words of praise for Edgeworth also.

I find it to be the only tobacco giving me complete satisfaction. It certainly is a pleasure to smoke a tobacco with a pleasant taste, which at the same time does not bite the tongue. I have tried many brands of tobacco recommended by friends, but have only been able to enjoy one tobacco thoroughly, Edgeworth. Now I take tips on good tobaccos from no one, as I am satisfied in my own mind that there is no better tobacco sold than Edgeworth.

Please put me down as an Edgeworth booster. It's a smoke fit for a king.

Yours sincerely,
G. E. M.,
Los Angeles, California.

Which proves again that tobacco taste is an individual matter. Two friends may agree on the merits of a book, a play, or almost anything—and at the same time be as far apart as the north and the south poles on their opinions of a tobacco.

Let us send you free samples of Edgeworth so that you may put it to the pipe test. If you like the samples, you'll like Edgeworth wherever and whenever you buy it, for it never changes in quality. Write your name and address to Larus & Brother Company, 10D South 21st Street, Richmond, Va.

Edgeworth is sold in various sizes to suit the needs and means of all purchasers. Both Edgeworth Plug Slice and Edgeworth Ready-Rubbed are packed in small, pocket-size packages, in handsome humidors holding a pound, and also in several handy in-between sizes.

We'll be grateful for the name and address of your tobacco dealer, too, if you care to add them.

To Retail Tobacco Merchants: If your jobber cannot supply you with Edgeworth, Larus & Brother Company will gladly send you prepaid by parcel post a one- or two-dozen carton of any size of Edgeworth Plug Slice or Edgeworth Ready-Rubbed for the same price you would pay the jobber.

Better Shop Methods

How You Can Earn Money for Photos of Ingenious Tools

FOR interesting photographs of time-saving tools and fixtures, such as those shown below, POPULAR SCIENCE MONTHLY is making a special offer of $4 each.

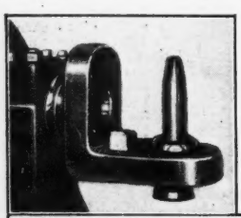
If you are a mechanic, no doubt you have made at some time or other an especially useful or unusual tool or fixture to accomplish work that could not be done so easily with your regular tools. The chances are there was nothing on the market you could buy to serve the purpose of the tool you made, and, although it may have given service only on a few occasions, it probably paid for itself many times.

If you have made such a tool, send a clear photograph of it, with a brief description of its construction and purpose, to the Editor, Better Shop Methods Department, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York. For each photograph available for publication, POPULAR SCIENCE MONTHLY will pay $4.

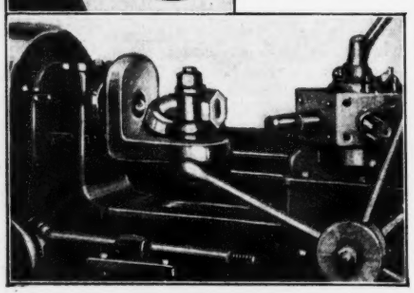
Jig for Angle Cock

BY USING the jig illustrated, I can machine an angle cock completely in four minutes. The jig is used in centering, boring, reaming, counterboring, and tapping angle cocks used on airbrake equipment.

The reason the angle cocks are bored is because the threads are worn or broken



A simple fixture to hold airbrake angle cocks while machining them in a turret lathe. It increased production more than 50 per cent



off after some service and it is necessary to bore them out to 1 23/32 in. and thread with 1½-in. pipe tap in order to screw in a 1½ by 1¼ in. bushing.

The work was first done in a drill press, but so much time was lost changing tools that I had this jig forged out. It increased my production more than 50 per cent.—ARCHIE SKINNER, Chicago, Ill.

Building Brick Polishes Cast Iron

FOR smoothing and polishing the meeting surfaces of cast-iron doors and hand-hole covers, an ordinary brick is unsurpassed. It evens up depressions and projections. Ammonia leakages in one case were decreased by its use more than by any other method of smoothing the doors.

On the Deagan Xylorimba

Become a crack Xylorimba player right in your own home. Easiest instrument to play. Everyone enjoys it—anyone can learn to play it. We furnish you free 14 complete lessons. Learn to play in a few hours. Earn $80.00 to $200.00 a week. Deagan instruments are world renowned—used extensively in leading dance, theatre and concert orchestras, and for Radio Broadcasting. Yet the cost of the Deagan Xylorimba is no greater than any other good instrument.

FREE LESSONS—A YEAR TO PAY

Our free trial and easy payment plan make it easy to learn at home. Send coupon below for illustrated literature and details of our special free trial offer.

—Mail Coupon Today!—

J. C. DEAGAN, Inc., Dept. 1364
Berteau and Ravenswood Aves., Chicago, Ill.

Gentlemen: Without obligation please send me full information regarding your Free Trial Deagan Xylorimba offer.

Name .....

Address .....

.....

TYPEWRITER PRICES CUT

Your choice of the World's best typewriters—Underwood, Remington, Oliver—full size, late model, completely rebuilt and refinished brand new. Prices smashed down to half. Act quick.

Free Trial

$2 and it's yours

Just send your name and address and we will mail you our complete **FREE CATALOG** prepaid, fully describing and showing actual photographs of each beautiful machine in full colors. Tells every detail of our direct-to-you small-payment plan. Write now for tremendous saving. No obligation whatever. Still time if you act now.

International Typewriter Exchange
186-188 W. Lake Street. Department 438 Chicago, Ill.

FREE

Fine Tone
$20 Musical Instruments

We have a wonderful new copyrighted system of teaching note music by mail! To first pupils in each locality we will give free a $20 superb Violin, Tenor Banjo, Ukulele, Hawaiian-Guitar, Banjo-Mandolin, Banjo-Ukulele, Banjo-Mandolin, Cornet or Banjo-Guitar absolutely free. Also teach Piano and Organ. Very small charge for lessons only. Four lessons will teach you several pieces. Over 100,000 successful players. We guarantee success or no charge. Complete outfit free. Write today. Dept. 1601. No obligation.
Slingerland School of Music, 1815 Orchard St., Chicago, Ill.

ZIP-ZIP

THOUSANDS of boys are made happy with this wonderful Zip-Zip shooter, something every boy wants and never gets tired of. Zip-Zip shooter is scientifically and practically made; boys, if you like hunting and outdoor sports, get a Zip-Zip shooter with plenty of pep and force and learn that quick and sure aim. If your dealer happens not to have them, order from us. Zip-Zip shooter complete 35c or three for $1.00; send stamps, coin or money order.

AUTOMATIC RUBBER CO., Dept. 22, COLUMBIA, S. C.

Ford Runs 57 Miles on Gallon of Gasoline

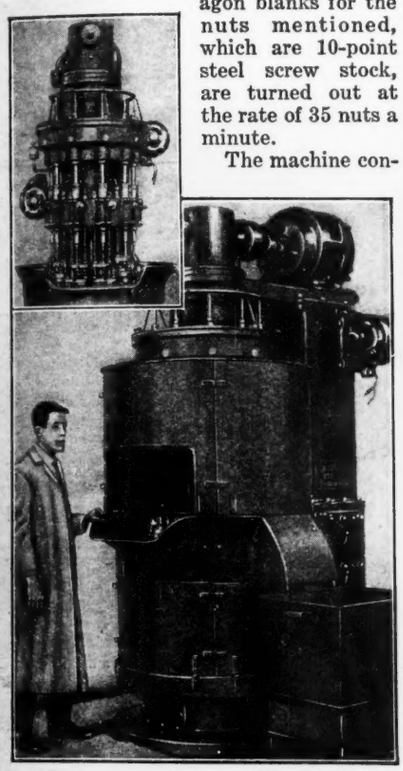
A new automatic and self-regulating device has been invented by John A. Stransky, 26 Fourth St. Pukwana, South Dakota, with which automobiles have made from 35 to 57 miles on a gallon of gasoline. It removes carbon and reduces spark plug trouble and overheating. It can be installed by any one in five minutes. Mr. Stransky wants distributors and is willing to send a sample at his own risk. Write him today.—Adv.

Better Shop Methods

New 10-Spindle Drilling Machine Operates Continuously

THE new 10-spindle continuous rotary drilling machine illustrated was designed and built for drilling holes ½ in. in diameter and 1 in. deep in collar hexagon nuts used on automobile disk wheels. It is adaptable, however, for drilling other parts of a similar kind.

Machinists used to an ordinary drill press will be particularly interested in this machine because of the amount of work it handles. The cold pressed hexagon blanks for the nuts mentioned, which are 10-point steel screw stock, are turned out at the rate of 35 nuts a minute.



The operator merely has to slip a blank into each work-holding fixture as it passes by

The machine consists of a stationary round post mounted on a base. A circular carrier supports 10 drilling spindles with their respective work tables and actuating mechanism, all of which revolve around the base.

The cutting feed to the work table is obtained by a cam mechanism timed to give the operator an opportunity to load. The locating and holding of the nuts is automatic. All the operator has to do is to slide a blank nut approximately into position in each of the fixtures as it passes by. The ejecting of the nuts is automatic.

Copper Tool Used as Indicator

IN TRUING up pulleys, shafts, studs, or other finished work in a lathe when no indicator is available, a copper tool may be used. The tool should be ground to a diamond point.

Tighten the tool or tool-holder in the toolpost and run the copper point against the revolving work until it touches the high spot. Then adjust the work until it shows a copperish line of even width all around.—W. J. T.

Sweeney Trains Men To Make Big Money!

You've long wanted to come to this Million Dollar School, *the World's Largest Automotive and Electrical School* at Kansas City, Mo. NOW IT WILL BE EASY, because of my big reduction in cost of tuition. I've raised the salaries of thousands of other fellows—I can do it for you, and if you decide now to come here, spend a few weeks in actual "Learn by Doing" training, there's a good job paying big money ready for you or a chance to go into business for yourself. But, you'll have to decide NOW to be sure of the big saving in cost of training.

E. J. SWEENEY, President.

Auto Mechanics $50 Week and Up

Learn a Good Trade

One that will pay you $200 to $500 a month and more. Get in the biggest business in the world—the Automotive Business. I want to prove that you can do what thousands of men just in your position have done as a result of "SWEENEY TRAINING." I say, take up the AUTO BUSINESS NOW. Learn it at SWEENEY'S, *Kansas City, Mo.* Act now while you can get the big saving in tuition.

Get the Best for Less Money

The SWEENEY AUTO SCHOOL offers you the greatest opportunity you ever had. A big reduction in tuition—a Million Dollar building—10 stories high—over 12 acres of floor space devoted to the *"Sweeney System of Practical Instruction"* under expert instructors. Just across the plaza from the Union Station—a short distance from the beautiful new Two Million Dollar Memorial Building. BUT, REMEMBER THERE'S ONLY ONE SWEENEY AUTO SCHOOL—THERE'S ONLY ONE SWEENEY SYSTEM and you can only get this system at Kansas City, Mo. You positively cannot get it anywhere else.

And Now Cuts The Tuition 1/2 So You Can Start Your Training At Once

There's Only One Sweeney School
It's at Kansas City, Mo.

COME RIGHT NOW. This is the most amazing offer I ever made. If you are mechanically inclined, if you like to work with tools, you will learn under the "Sweeney System" by actually doing the work, everything about all kinds of automobiles, oxy-acetylene welding, vulcanizing, battery work, electrical work, building and repairing Radio sets. No experience or education needed. No books are used. You work on most complete gas engine and electrical equipment in any school in the world. Over $200,000 invested. $50,000 Radio Station WHB. You'll get dirty and greasy, but you'll learn by the "Sweeney System" that fits you for the big pay jobs at $50 a week and up, waiting for Sweeney trained men.

Sweeney System OF PRACTICAL INSTRUCTION

There's only one place where you can get this training—it's at the world-famous **Sweeney Automotive and Electrical School of Kansas City.** There's only one Sweeney School—the largest in the world. There's only one "Sweeney System." No other school offers or can give you this training that not only trains you to fill big paying jobs but saves you time and money. This training is making big money for 60,000 Sweeney Graduates. I estimate 20,000 of them own a good paying business.

Battery Experts $200 Month and Up

My Free Book Tells You

How to get a good mechanical job.
How to learn to be a chauffeur or truck driver.
How to learn to repair any make of car.
How to learn to make batteries and auto tires.
How to weld.
How to run a garage anywhere.
Shows you hundreds of actual photographs of men at work in my big shops.
Shows how 60,000 men got their start. Shows how easy it is to learn several good trades; how much fun you have during recreation hours, swimming pool, entertainment, band and orchestra, radio broadcasting Station WHB.
Answers every question.
64 pages beautifully illustrated.

WRITE ME TODAY or wire me when you'll be here. Don't wait. Come right now. Sweeney trained men in demand everywhere, $200 to $500 a month and more. You must decide now if you want to be sure of getting the big reduction in tuition. Write for my Big FREE 64-page book or wire me you are coming. No colored students accepted.

E. J. SWEENEY, Pres.

There's Only One Sweeney School. It's at Kansas City, Mo.

INVENTORS PROTECT YOUR IDEAS

Send for our Guide Book, **HOW TO GET A PATENT,** and Evidence of Invention Blank, sent Free on request. Tells our terms, methods, etc. Send model or sketch and description of your invention for our **Instructions. No Charge for the Above Information.**

RANDOLPH & CO.
Dept. 130, Washington, D. C.

NAME.....
STREET.....
CITY.....STATE.....

Ⓢ **This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.**

The New

FRESHMAN MASTERPIECE

Complete Knockdown Set

To Build the Five Tube Tuned Radio Frequency Receiver

THIS WONDER knockdown set contains every single part necessary to construct the FRESHMAN MASTERPIECE.

Here's just what you get:

1 Genuine Bakelite Front Panel, completely drilled and engraved.
1 Genuine Bakelite Sub-Panel — with sockets, binding posts and grid condenser already in proper place. All mounting holes properly drilled.
3 Masterpiece Tuned Radio Frequency Units—perfectly matched and balanced.
3 Beautiful Genuine Bakelite 4-inch Dials.
1 Freshman Variable Grid Leak and .00025 M.F. Condenser.
1 Freshman 5 to 1 Audio Transformer.
1 Freshman 3 to 1 Audio Transformer.
1 Freshman .002 Fixed Mica Condenser
1 Freshman .006 Fixed Mica Condenser.
2 Freshman Single Circuit Jacks.
1 Freshman Filament Control Switch.
1 Freshman 30-ohm Rheostat.
1 Freshman 6-ohm Rheostat

and every bracket, screw, nut, bushing that you will require as well as an ample supply of spaghetti and bus bar. It certainly is

The Kit the Whole World's Been Waiting for

And all for only **$39.50**

A 24-page book of instructions packed with every kit. Seven full-page illustrations and many smaller ones explain every operation step by step.

Ask To See It At Your Dealer's

Look for our trademark and serial number riveted on the sub-panel. The kit is not guaranteed if number has been removed or tampered with.

Chas. Freshman Co. Inc.
Radio Receivers and Parts
FRESHMAN BUILDING
240-248 WEST 40TH ST.-NEW YORK, N.Y.

Better Shop Methods

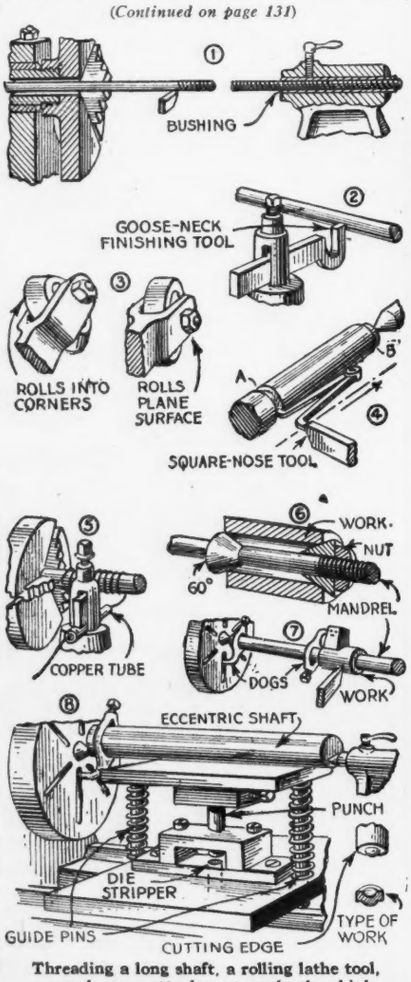
Lathe Shortcuts that Save a Machinist's Time

By F. J. Wilhelm

THERE are many simple little tricks in lathe work that a machinist can use on occasion to cut down materially the time required in machining certain jobs. A few of those I have found useful in my own work are described below and they will suggest a number of others to any alert mechanic.

A job too long to be finished between centers, such as turning a long shaft or cutting the thread on a long lead screw, may be handled as shown in Fig. 1. Make a bushing to fit the spindle hole in the tailstock, the inside diameter a nice running fit for the shaft or screw. The first section, which will be limited by the dis-

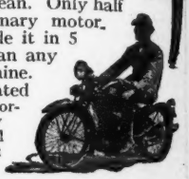
(Continued on page 131)



Threading a long shaft, a rolling lathe tool, a punch-press attachment, and other kinks

Motor to Work or Sport— at 1/3¢ per Mile!

SAY goodbye to crowded trains and trolleys. Motor to work or sport for less than carfare. The New Indian Prince, the Personal Motor, goes 90 miles on a gallon. Light—safe—clean. Only half the weight of an ordinary motorcycle. You learn to ride it in 5 minutes. Costs less than any other high-grade machine. Write today for illustrated booklet containing full information about this new Indian Prince, the Personal Motor, and how easily you can buy it.



Indian Motocycle Co.
Dept. H-4, Springfield, Mass.

A 3-PLY BARGAIN

Here is one of the biggest offers we have ever made. Read it carefully. Remember it is limited to a short time—send in your order NOW.

(1) The famous Little Hustler Motor—known and used in every part of the world, 3½ inches high, three pole armature, ⅝-inch pulley, runs on a single 6-inch by 2½-inch dry cell or on 110 volts a. c. through a transformer.

(2) Specially equipped for this offer with a 4-inch nickel plated fan—see illustration. *Makes a real electric fan.* Tremendous speed, wonderful breeze. Fan detachable.

(3) Fascinating book, illustrated with photographs and engineers drawings, diagrams, etc., on the nature and kinds of Electricity. Contains complete illustrated directions for building a real motor yourself AT A COST OF ONLY $1.50.

This is a special offer, limited to a short time only. Send us no money. Simply tell us to send you this outfit and when it arrives pay postman $2.00 plus a small postage fee. ONLY $2.00 FOR A SHORT TIME ONLY.

KNAPP ELECTRIC CORPORATION
Dept. 24 Port Chester, N. Y.

MAKE MONEY AT HOME

You can earn good money at home in your spare time making show cards for us. No canvassing or soliciting. We show you how by our new simple instructograph method. We supply both men and women with work at home, no matter where you live, and pay you cash for all work completed each week. Full particulars and booklet free. Write today.

AMERICAN SHOW CARD SYSTEM LIMITED
206 Adams Building, Toronto, Canada

HAVE YOU AN INVENTION?

If so the WORLD PROGRESS will show you how to

Protect and Profit From Your Ideas

Sample copy free. One year's subscription 40c. Send for free book,

"WHAT TO INVENT"

containing **Suggestions to Inventors** as to Inventions Needed. We invite manufacturers to address us regarding inventions they want.

WORLD PROGRESS PUB. CO., INC.
Room 202 Victor Bldg. Washington, D. C.

Drive This Beautiful Raceabout Instead of Your OLD FORD

Choice of Four Colors; Flat or the Bullet Nose Radiator Shell. Send for 1925 Free Catalog of New Auto Acces', Bodies and Speed Equipment. Direct from Factory.

AMERICAN TOP AND BODY CO., Beech Street DELPHI, IND.

I Offer You $8.00 a Day and a DODGE TOURING CAR

Write quick for new proposition. We offer $8.00 a day and new Dodge touring car, for demonstrating and taking orders for Comer Top Coats and Raincoats. Spare time. No experience required. Sample outfit free. Write now.

Comer Mfg. Co., Dept. O-410, Dayton, O.

Ⓢ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

NOTHING BUT THE TRUTH

Reports that the famous Polyplug infringes existing patents owned by a competitor are absolutely without foundation in the opinion of competent counsel who have minutely investigated the situation.

The manufacture and sale of Polyplug will be continued—and the quality and merit of Polyplug will continue to keep it far in the lead of a host of inferior plugs.

These features have made Polyplug the envied leader of its field:

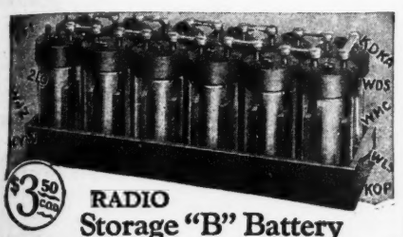
POLY PLUG

75¢ IS

Positive Pole Plainly Marked on Sleeve Contact.

Positive Permanent Contact. No screws or 'trick' parts. Wires quickly and easily attached — pulling and jarring cannot loosen contact. Instantaneous changing from headphones to speaker. Made of genuine Bakelite. Send for Circular H

POLYMET
Manufacturing Corp.
70-74 Lafayette St., New York



$3.50 Coupon

RADIO
Storage "B" Battery
12 Cells 24 Volts *Lasts Indefinitely—Pays for Itself*

Economy and performance unheard of before. Recharged at a negligible cost. Approved and listed as Standard by leading Radio Authorities, including Pop. Radio Laboratories, Pop. Sci. Inst. Standards, Radio News Lab., Lefax, Inc., and other import at institu ions. Equipped with *Solid Rubber Case*, an insurance aga nst acid and leakage. Extra heavy glass jars. Heavy rugged plates. Order yours today!

SEND NO MONEY Just state number of batteries wanted and we will ship day order is received. **Extra Offer:** 4 bat eries in series (96 volts), $13. Pay expressman after examining batteries. 6 per cent discount for cash with order. Mail your o der **now!**

WORLD BATTERY COMPANY
1219 So. Wabash Ave., Dept. 80, Chicago, Ill.
Makers of the Famous World Radio "A" Storage Battery
Prices: 6-volt, 100 Amp. $12.50; 120 Amp. $14.50; 140 Amp. $16.00. All equipped with Solid Rubber Case.

World STORAGE BATTERIES FOR RADIO IS

KDKA - WEAF - WGN - WJS - KHJ - KGO - KFAF - WJY - KOP

Your Tires Free and $300 a month

15,000 Miles Guaranteed

Agent Users Wanted

SEE how easy it is with the MASTER SALESMAN KIT, which I send Free, to make $10 to $15 a day in your spare time showing MELLINGER TIRES at BIG SAVING to car owners. This powerful, handmade, oversize, non-skid Cord is guaranteed by Bond for mileage half way around the world.

The Mellinger Plan starts you in business, all or part time; no capital or experience needed. Tires shipped prepaid on approval. Lowest wholesale prices in America.

FREE If you will boost MELLINGER TIRES, I have a surprising offer that will give you a set of tires Free. Also the Master Salesman Kit with final wholesale prices and big free book. Simply send name today to nearest address. S. L. MELLINGER, Pres.

MELLINGER TIRE & RUBBER CO.
Philadelphia, Pa. Dept. 1929, Kansas City, Mo.

Better Shop Methods

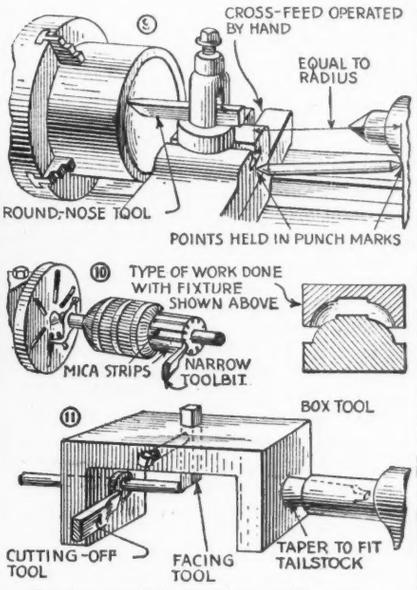
Lathe Shortcuts that Save a Machinist's Time

(*Continued from page 130*)

tance between centers, is machined with the center in place in the usual way and driven with the chuck.

When this is completed, remove the tailstock spindle and insert the bushing, which is to be used as a steady rest bearing and center. Move the screw or shaft along through this bushing and through the hollow spindle of the headstock for a sufficient distance to allow another section to be turned. If a thread is being cut, have enough of the thread remain outside the bushing to start the new cut. This operation is repeated as necessary.

In cutting a square or acme thread, a great deal of time may be saved by the



Turning a spherical surface, truing a commutator, and using a box tool for small pins

use of two tools. First, rough out the thread with a tool that is 1/32 to 1/16 in. narrower than the finished size of thread. Then follow with the finishing tool. This method avoids tool breakage and stopping to grind the tool, as very little stock is left for the finishing tool to remove. It also speeds up the work noticeably.

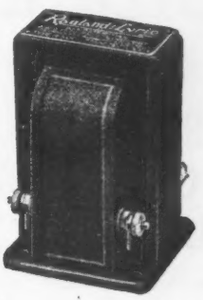
The tool shown in Fig. 2 leaves an excellent finish when turning long shafts with a light cut and coarse feed; practically no filing will be necessary. Grind the cutting edge as for regular square-nosed finishing tools. If water is allowed to drip on the point of tool while in use, the finish will be improved, but the work should be smeared with oil afterwards to prevent rust.

Another style of tool suitable for finishing heavy shafts and similar jobs is shown in Fig. 3. A holder carries a hardened steel roller, which is brought to bear against the work with considerable pressure in the same manner as a knurling tool. The finish is rolled on.

A good method for setting the lathe accurately for turning a taper, when it is not equipped with a taper attachment, is

(*Continued on page 132*)

RMA



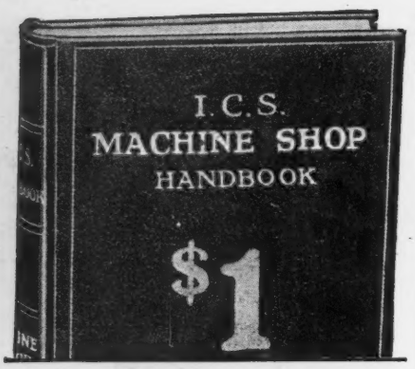
Radio Music for the Critical

Music lovers especially delight in Rauland-Lyric. Used in all audio amplifying stages of a radio receiver, it reproduces with fidelity those elusive refinements of tone quality which, to the trained ear, mean artistic excellence.

Rauland-Lyric is a laboratory-grade audio transformer designed especially for music lovers. The price is nine dollars. Descriptive circular with amplification curve will be mailed on request. All-American Radio Corporation, 2668 Coyne St., Chicago.

IS

Rauland-Lyric
AN ALL-AMERICAN TRADE MARK TRANSFORMER
The Choice of Noted Music Critics



MACHINE SHOP HANDBOOK

A wonderful book for machinists, toolmakers and shop men

335 Pages—282 Illustrations

THIS I. C. S. MACHINE SHOP HANDBOOK is a wonderful bargain at $1. Contains more common sense, practical information than any other book of its kind ever published. Pocket size. 335 pages. 282 illustrations. A book that you will find invaluable in your daily work. Will help you get a better job and a bigger salary.

Price only **$1**

Contents

Useful tables, mensuration, trigonometry, properties of materials, drilling, reaming, tapping and threading, lathe work, threads and thread cutting, measuring and testing, milling-machine work, indexing, helixes and spirals, key work, gearing, planer work, shaper work, slotter work, broaching, grinding and polishing and lapping, jigs and fixtures, punch and press work, die casting, gauges, micrometers and vernier instruments, lubricants, temperature indicators, metals, heat treatment, chilled iron, welding and brazing and soldering, coating and protecting, filing, stock estimating, chipping, riveting, pipe bending, laying out work, blue prints, belting, pulleys and shafting, knots and hitches, springs and miscellaneous shop hints.

Just mail this advertisement with a dollar bill and your name and address, and this 335-page I. C. S. MACHINE SHOP HANDBOOK or any of the other I. C. S. Handbooks that you want will come to you by return mail. Money back if not satisfied.

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 7648-D, Scranton, Penna.

I enclose $....., for which send me, post-paid, the Handbooks marked X, at $1 each. It is understood that if I am not entirely satisfied I may return any or all of them within five days and get my money back.

☐ MACHINE SHOP HANDBOOK
☐ Automobile Handbook
☐ Electrical Handbook
☐ Chemistry Handbook
☐ Pharmacy Handbook
☐ Traffic Handbook
☐ Building Trades Handbook
☐ Radio Handbook
☐ Salesman's Handbook
☐ Advertising Handbook
☐ Bookkeeper's Handbook
☐ Civil Engineer's Handbook
☐ Steam Engineer's Handbook

Name.....

Address.....

RADIO ENCYCLOPEDIA

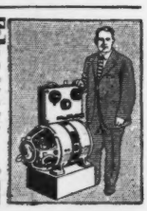
FREE! Thousands of radio bargains: standard sets, standard parts for sets, vacuum tubes, etc., at one-third less than regular prices, also latest information on all circuits, complete list of broadcasting stations and other valuable data. Send name and address, we'll send you 50c book FREE! FREE SERVICE DEPARTMENT, Mr. Decker of N Y Evg. World will help you solve your radio problems, and furnish up-to-date information on set construction, operation improvement. This service FREE to our customers. Write today!

NORWALK RADIO CORP
Dept. 54-C, 66 READE ST. NEW YORK

HB ONE DAY BATTERY CHARGING

Start a money-making business of your own that brings $150 to $300 clean monthly profits. No experience needed to operate HB One Day Battery Charging Outfit. $35 cash brings complete HB Outfit. Easy terms—money back guarantee. Write for free bulletin No. 45.

HOBART BROS. CO.,
Box P 4, Troy, Ohio



EASILY CLEARS $150 to $300 MONTHLY PROFIT

Better Shop Methods

Lathe Shortcuts that Save a Machinist's Time

(*Continued from page 131*)

suggested in Fig. 4. Two spots, *A* and *B*, are turned on the piece. *A* corresponds to the diameter of the large end of taper and should be just the right distance from the shoulder to the end of taper. *B* represents the diameter at the small end. The angle of the taper is set parallel with the line of tool travel by moving the tailstock until both spots are exactly equal distances from the point of the tool. This distance may be tested with an inside caliper, as shown. If the measuring is done carefully, there will be no doubt about the accuracy of the taper and very little, if any, filing will be required.

Winding springs on a lathe is an awkward job for some mechanics. It does not need to be so if the method illustrated in Fig. 5 is followed. The wire is passed through a short piece of brass or copper tubing and the end is gripped under one chuck jaw. Insert a tool or short steel block in the toolpost between the screw and the tube and press the tube down flat, just tightly enough to allow the wire to pull through without breaking. Gear the lathe for the right pitch and proceed to wind the spring with the slow back gear speed.

THE mandrel in Fig. 6 will find many uses in any machine-shop. It is a time-saver for turning bushings, pulleys, gears, or any cylindrical shapes within its capacity. It is especially useful for a job where the hole is over size and will not fit a standard mandrel, as well as for turning a job having a cored hole that is not to be bored out. The movable cone should be a nice sliding fit and the nut should have a right-hand thread.

Figure 7 shows an effective way to drive a job on a mandrel when there is a heavy overhang that perhaps would cause the work to slip around on the mandrel, as is frequently the case when turning and facing castings with a small hole.

We seldom think of a lathe doing the work of a punch press, but Fig. 8 suggests how this is possible and practical when the shop is not equipped with a press. The punch and die are constructed along conventional lines and supported in position by the saddle or by cross pieces resting on the ways of the lathe. The punch holder is bolted to a top plate, which comes in contact with an eccentric shaft held on the centers and driven by a dog in the usual way. Each revolution of the spindle gives a stroke to the punch, and the speed is limited only by the ability of the operator to feed the material through the die. The punch and die are assembled as one unit. The fiber washer shown was a job produced by this method.

As there are more ways than one to skin the proverbial cat, so there are more ways than one to produce a spherical surface on a lathe. A novel and interesting method for doing this is indicated in Fig. 9. A piece of drill rod pointed at both ends does the trick. The over-all length is equal to the radius of the circle to be

(*Continued on page 133*)

TRUSSES BANISHED

NEW SAFE WAY!

Now you can throw away forever steel bands, chafing leg straps and other heavy makeshift devices. For a well known American scientist has found a new easy way to support rupture assisted by means of a wonderful little invention weighing less than 1-25 of an ounce. Not only do you do away with the objectionable pressure and tight strapping, but you eliminate the "coming down" of rupture—when running, straining, exercising, sneezing, etc.—which too frequently leads to strangulation. So great has been the success of this wonderful device that it is being offered to ruptured people on an absolute guarantee of instant satisfaction or no cost. Simply drop a postcard or letter requesting free literature to **NEW SCIENCE INSTITUTE, 4011 Clay Street, Steubenville, Ohio.**

Learn Cartooning

At Home—In Your Spare Time

from the school that has trained so many successful cartoonists of today earning from $50 to $200 and more a week. The Landon Picture Chart Method of teaching makes **original** drawing easy to learn. Send 6c in stamps for full information and chart to **test your ability.** *Also state age.*

THE LANDON SCHOOL
1451 National Bldg., Cleveland, O.

DEAFNESS IS MISERY

I know because I was Deaf and had Head Noises for over 30 years. My invisible Antiseptic Ear Drums restored my hearing and stopped Head Noises, and will do it for you. They are Tiny Megaphones. Cannot be seen when worn. Effective when Deafness is caused by Catarrh or by Perforated, Partially or Wholly Destroyed Natural Drums. Easy to put in, easy to take out. Are "Unseen Comforts." Inexpensive. Write for Booklet and **my sworn statement** of how I recovered my hearing.

A. O. LEONARD, Suite 301, 70 5th Ave., New York

MOVIES IN YOUR HOME

Our marvellous, practical MOVIE MACHINES sell as low as $3.75 postpaid and use same size film as big theatres. We also have wonderful films at lowest prices—with a new film exchange service. DON'T MISS THIS! *Write NOW for free catalogue*

PARAMOUNT MFG. CO.
Dept. PS 7 Boston, Mass.

Clear Your Skin!

Your Skin Can Be Quickly Cleared of Pimples, Blackheads, Acne Eruptions on the face or body, Barbers Itch, Eczema, Enlarged Pores and Oily or Shiny Skin.

FREE Write today for my **FREE BOOKLET, "A CLEAR-TONE SKIN,"**—telling how I cured myself after being afflicted 15 years.

E.S.GIVENS, 153 Chemical Bldg., Kansas City, Mo.

Start a Movie Show

SMALL CAPITAL STARTS YOU Big opportunity to become independent. **No experience needed.** We show you how. Our easy payment plan makes it easy to start. We equip you complete. Our machines used and endorsed by government institutions. Write today for free catalog.

ATLAS MOVING PICTURE CO.
536 S. Dearborn St, Dept. 77, Chicago

ARITHMETIC OF ELECTRICITY

A practical treatise on electrical calculations of all kinds reduced to a series of rules, all of the simplest forms, and involving only ordinary arithmetic. 200 pp. **Price, $1.50.**

POPULAR SCIENCE MONTHLY
250 Fourth Avenue :: NEW YORK

SELL BY MAIL

Mail Order Men, send for our Dollar Making Circular Service. Circulars with your imprint furnished at one-fourth original cost. Make 92 cts. profit on each dollar order. Add our service to your regular line and watch profits grow. PARTICULARS FREE!

D. L. ELFCO, 525 S. Dearborn, Chicago

Ⓢ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

This Book FREE

SMOOTH-ON REPAIR BOOK

144 pages and valuable to those who want dependable household, automobile and shop repairs with big savings.

Smooth-On No. 1

On your car, stops leaks in radiator, bursted water jackets, tank, hose connections and at gaskets without taking down. Keeps bolts, nuts, grease cups and hub caps from dropping off.

In your home, stops leaks in water, gas and steam pipes, tanks and pots, roofs, etc.

In the shop, makes any kind of pressure joints, joins wood, metal, glass and concrete to each other and holds on any metal—iron, brass, lead, aluminum. Makes handles, screws and nuts lastingly tight.

Be your own "fixer" and save much money for better things.

To get perfect results, write to us for and *use* the Smooth-On Repair Book. Free if you mention this magazine. *Get Smooth-On No. 1 in 6-oz., 1 lb. or 5 lb. tins at any hardware store.*

SMOOTH-ON MFG. CO.
Dept. 58
574 Communipaw Ave., Jersey City, N.J.

Ask your Radio Dealer
to show you these
KELLOGG PARTS:

Audio Frequency Transformers
New-Type Low-Loss Variable Condensers
Radio Frequency Transformers

Write today for free 5-tube radio frequency circuit diagram

KELLOGG

Kellogg Switchboard & Supply Co.
Chicago, Illinois

Agents: $6 Per Day and up

Selling concentrated, non-alcoholic food flavors. Always fresh. Put up in collapsible tubes. Ten times the strength of bottled flavors. Guaranteed under U. S. pure food laws. All flavors. Sells in every home. Used every day. Not sold in stores. Big demand. Big repeater. 100 per cent profit.

Men or Women can make big money. Have sold over $300 in one month. You will find this a big, easy seller and a sure repeater. Must satisfy customers or money back. Write for territory and sample outfit. Get a big line of customers. Get repeat orders every month and have a steady income. Write quick.

American Products Co.
1177 American Bldg., Cincinnati, Ohio

Act Quick Write To-day

Saw Books FREE

"Saws in the Shop," "Saw Sense," "Saws on the Farm."

Just send us your name and address and say which of these helpful books you want and we will send it FREE. Write NOW.

E. C. ATKINS & CO., Inc.
Dept. D-20 Indianapolis, Ind.

Tool Cases

for Machinists, Carpenters and Tool Makers; none better; thirty styles. Quartered oak and metal covered. Ask for booklet.

"Built for Service"

The Pillied Lumber Co., Swanton, Ohio

Better Shop Methods

Lathe Shortcuts that Save a Machinist's Time

(*Continued from page 132*)

turned. A center punch mark is made on the side of the cross compound and a similar mark is put on the tailstock in the center and in the same plane as the one on the compound.

The circle first is roughed out as closely as possible to a templet. The points of the rod are placed in the punch marks and the carriage held hard against the rod. By using a round nose or any suitable tool, the job then may be finished to a true circle. Engage the cross feed and hold the carriage against the rod while the tool is cutting.

Either concave or convex surfaces may be produced by this method. For a concave surface hold the rod against the tailstock. For convex surfaces put the rod on the opposite side and hold it against the headstock.

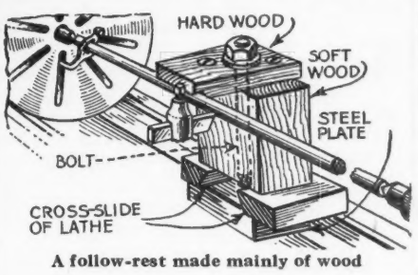
Have you ever tried to true up a commutator and bring the mica down smooth with the surface with a hacksaw blade or other means? A much better and quicker way is by planing it off with the lathe carriage. Grind a tool such as a cutting-off tool from 1/16 to ⅛ in. wide. Give the tool one-quarter turn in the holder, with the cutting edge toward the shoulder, and plane the mica in each groove down smooth by working the carriage back and forth by hand (Fig. 10).

Figure 11 illustrates the use of a box tool in the engine lathe. A tool of this type may be rigged up for many small manufacturing jobs, such as turning, facing, and cutting off small pins, small bushings and similar jobs. Many variations of this tool are possible and with different size guide bushings, many sizes of stock may be handled.

Cheaply Made Follow-Rest

THE follow-rest illustrated is an aid in turning shafts of small diameter, especially when other equipment is not available. This simple arrangement will do the work as well as a more expensive special follow-rest.

A wooden block is cut and drilled to receive a machine bolt. The top piece,



A follow-rest made mainly of wood

which bears against the shaft, is of hard wood and is mounted on the block with wood screws. The follow-rest is bolted to the carriage with a machine bolt, which passes down into a plate under the ways of the cross slide. When necessary, the bearer can be adjusted for height with packing pieces.—CHARLES KUGLER.

SANDS LEVELS

Strong and Light

THESE aluminum levels have unusual strength. The lenses are made of a non-brittle glass that withstands rough usage. You can use a Sand's for overhead work and at arm's length without fatigue.

Plumb Right

Window frames and doors are plumb when you use a Sand's. So are walls and foundations. Sand's accuracy is built-in by factory experts.

Sealed Tight

The spirit tubes are set and sealed immovably. Sand's accuracy is permanent. The protecting lenses form a double-seal that is dust-proof and moisture proof.

The Choice of Master Craftsmen

Sand's is the "buy" word for levels with careful workmen everywhere. Sand's Levels have made good on the job for thirty years.

At Good Hardware Stores Everywhere

SANDS LEVEL & TOOL CO.

5849 Fischer Ave., Detroit, Mich.

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

SILENT MODEL NO. 8 For This Bargain

HAVE you a good typewriter in both your home and office? If not, you are running the risk of costly errors, misunderstandings and criticism—no matter how well you write. All business and personal letters and invoices should be typewritten. It is the method used by modern men and women, old and young, and anyone can afford a machine on our plan. We will send you one of these wonderful typewriters with no obligation to you whatsoever. **Send no money.** Just fill out and mail the coupon. This brings full particulars of our **Free Trial Plan** made by special arrangement with the express company. Take advantage of our **Remarkable New Special Low Price Offer** which makes it so easy for you to own this handsome full size machine with all late style features and modern operating conveniences.

10 Days Free Trial!

We want you to give this wonderful typewriter bargain the most thorough test in your own home or office. You cannot imagine the perfection of this beautiful machine until you have seen it and used it. **You send no money.** When the typewriter arrives, you deposit only $3 with your local express agent. Test it thoroughly for ten days. Then if you are not satisfied it is the greatest bargain—the very finest typewriter you have ever seen, just return it to your express agent and he will promptly return your $3 to you. If you decide to keep it, you make monthly payments so small you will never miss them—just like rent—and then this wonderful typewriter is yours. No "red tape"—no annoyance—no delay. Five-year written guarantee with every machine.

A Lifetime Bargain!

We are giving you the lowest price ever made on this wonderful machine—late style models—up-to-date—just like new—absolutely highest quality rebuilt, perfect adjustment and fully guaranteed. The world famous **BALL-BEARING** L. C. Smith has set the standard of quality and long service for over 20 years.

It is the **easiest running** and **longest wearing** typewriter ever built. The choice of largest and discriminating users all over the world. Over half a million sold. No machine leaves our factory unless it is 100% perfect in every detail. Our prices are so low because **we are the world's largest exclusive dealers in L. C. Smith Typewriters.** You cannot buy a typewriter at anywhere near our price that will give you as many years of satisfactory service.

Free to You Now!

A Complete Course of Lessons on touch typewriting; Tools; and Waterproof Cover; Complete Operating Instructions; all given with your machine. This is the easiest typewriter to operate and learn. Anyone can use it.

Send the coupon now before this offer is withdrawn.

SMITH TYPEWRITER SALES CORP.,
321-360 E. Grand Ave., Chicago

FREE TRIAL COUPON

Smith Typewriter Sales Corp.,
321-360 E. Grand Ave., Chicago, U. S. A.

Send me your New Special Offer; Free Booklet of Valuable Typewriting Information; Your Catalog; and Free Trial Plan with no obligation to me.

Name _____

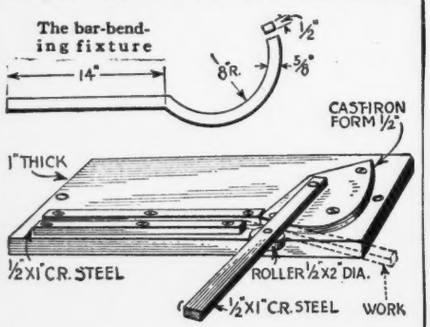
Address _____

Better Shop Methods

Simple Fixture Aids in Bending Bar Stock Quickly

THE bending fixture shown below was made for shaping a few special parts as cheaply as possible. In the same way many similar jobs may be handled at a minimum expense.

A flat cast-iron plate is planed on one side only. The form is turned to the correct radius and fastened to this plate with three fillister-head screws. Two strips of ½ by 1 in. cold-rolled steel are fastened to the plate adjacent to the form and with a



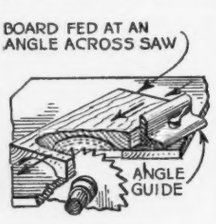
space between equal to the width of the stock that is to be bent—in this case ½ in.

The bending lever, which is a piece of ½ by 1 in. cold-rolled steel, swings on a stud passing through the center of the form. It is provided with a steel roll 2 in. in diameter, set to roll the work up close to the form. The lever stud has no nut on top, so that the lever can be removed for inserting and removing the work.

The work is heated at the point where the bend starts, and the sharp angular bend is made by holding it in the vise. The steel is put between the holding strips on the fixture, the bending lever is put on its stud, and the bend made.—H. L. W.

Cutting Odd-Sized Core Boxes on a Circular Saw

THE most difficult part of building a core box is in making the circular cut for the core. This often is done with a saw having a corresponding radius, but if the radius of the saw available differs from that of the cut to be made, the problem becomes more complicated, especially if there are no other tools at hand with which to do the work.



Sawing recess at an angle

This operation can be accomplished, however, by setting the guide on the saw table at an angle and cutting through in the way shown. Several light cuts aretaken, each being about the depth of the saw teeth. The saw is raised after each cut until the proper depth has been reached.

The angle to which the saw is set can be determined graphically, although from experience I have found the cut-and-try method quite satisfactory.—C. K.

FREE!

Everyone Interested in RADIO Should Write for this FREE Radio Book

THE Greatest Bargain Catalogue published. Chuck full of thousands of Radio Bargains at the lowest prices to be found anywhere in the United States.

Parts, Supplies, Sets, Parts for Sets, Latest Circuits.

Send for this catalogue TO-DAY.

We have friends in every City, Town and Hamlet. Our reputation is our bond. No red tape. Honest merchandise, goods shipped on approval. No risk—satisfaction or money refunded, no arguments, no money in advance. Ask this magazine about us!

WHOLESALE RADIO SERVICE
9 Church St. Dept A New York City

$450 A MONTH

We want a representative in every county at once to advertise, accept orders, deliver our marvelous new Quick-Edge Knife and Shear Sharpener to every home. No talking necessary. Sold upon absolute money-back guaranty.

$15.00 Per Day

Sharpens any kitchen, paring, carving knife, or shears in 10 seconds. A child can use it. No competition. Low priced. Leave fifty on trial—**fifty orders at 200% cash profits.**

Only $2.00 Selling Price

NEW INVENTION—JUST OUT

Abolishes dull knives and shears forever from every home. No charge for territory. Business furnishes capital. **Profits start first day.** No experience required. No delay. *Send no money.* Just write for complete particulars—*FREE.* Ray Carter, of Mass., sold 36 in 2 hours—*profit $36.* Forest Webb, of Pa., sold 12 in 3 hours—*profit $12.* Act at once. Write *Now.* Send name and address, and give name of your county.

QUICKEDGE SHARPENER CO.
864 Sharpener Bldg., Jackson, Mich.

Radio Inventors!

If you have a marketable idea, we have the necessary plant and facilities. Either royalty or outright purchase. Write us at once.

Box 10-F, Popular Science, 250 Fourth Ave., New York

EARN MONEY AT HOME

IN your spare time writing show cards. No canvassing or soliciting. We instruct you fully. Write today without obligation for full particulars and free booklet.

WEST-ANGUS SHOW CARD SERVICE LIMITED
Many satisfied pupils our best reference.
63 Colborne Building. Toronto, Can.

Inventor's Universal Educator

contains 900 mechanical movements; 40 perpetual motions. Tells how to obtain and sell patents. Suggests new ideas. Explains how to select your attorney and avoid patent sharks. Special price (for a limited time) $1.00 postpaid. Albert E. Dieterich, 681-A Ouray Building, Washington, D. C.

PATENTS
TRADE MARKS-COPYRIGHTS

PROTECT YOUR INVENTION

ANY NEW article, machine, design or improvement there[illegible], or any combination of parts or improvements in any known article which increases its efficiency or usefulness, **may be patented,** if it involves invention.

If You Have Any New Ideas

which you feel are useful, practical and novel, take prompt action to **protect your rights.** If you have invented any new machine or new combination of parts or improvement, or any new design or process, **SEND DRAWING, MODEL OR DESCRIPTION** of it for information as to procedure to secure protection.

DRAFTING and SPECIFICATION ROOM of CLARENCE A. O'BRIEN, Registered Patent Lawyer, Washington, D. C.

All communications are held in strict confidence. My personal, careful and thorough attention is given to each case. I offer you efficient, reliable and prompt service—based upon practical experience. Highest references.

NO CHARGE FOR ABOVE INFORMATION

Write today for free books, "How to Obtain a Patent" and **"Invention and Industry"** and blank form **"Record of Invention."**

These books will give you valuable information, and they may save you much time and effort. Send for them **now.** My practice is devoted exclusively to United States and Foreign Patents and Trade Marks. Write me freely, frankly and with full confidence; it is very probable that I can help you.

Use the Coupon attached, and immediately upon its receipt I shall send you the form Record of Invention to be returned to me with drawing, description or model of your idea; promptly upon receiving your idea I shall write you as to procedure and costs.

FREE

These Books Free

CLARENCE A. O'BRIEN
REGISTERED PATENT LAWYER

Member of Bar of Court of Appeals, District of Columbia, United States Court of Claims; Supreme Court of United States, Supreme Court District of Columbia.

FREE COUPON

CLARENCE A. O'BRIEN, REGISTERED PATENT LAWYER
8891 Security Savings and Commercial Bank Building
Directly across Street from U. S. Patent Office, Washington, D. C.

Please send me your free books, **"How to Obtain a Patent"** and **"Invention and Industry"** and blank form, **"Record of Invention,"** without any obligation on my part.

Name .....

Address .....

IMPORTANT—*WRITE OR PRINT NAME CLEARLY.*

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

"I'm Going to Make More Money!"

"I'm tired working for a small salary. I know I have just as good a head on me as Fred Moore and Bob Roberts, for we used to work side by side. But they've gone far ahead of me.

"Why? Because they saw the value of special training, and I didn't.

"But I know better now. If the International Correspondence Schools can raise the salaries of men like Fred Moore and Bob Roberts, they can raise mine, too!

"If they have helped others to advance, they can help me. To-day—right now—I'm going to send in this coupon and at least find out what the I. C. S. can do for me."

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 7647-D, Scranton, Penna.

Without cost or obligation on my part, please tell me how I can qualify for the position or in the subject *before* which I have marked an X:

BUSINESS TRAINING COURSES

☐ Business Management	☐ Salesmanship
☐ Industrial Management	☐ Advertising
☐ Personnel Organization	☐ Better Letters
☐ Traffic Management	☐ Show Card Lettering
☐ Business Law	☐ Stenography and Typing
☐ Banking and Banking Law	☐ Business English
☐ Accountancy (including C.P.A.)	☐ Civil Service
☐ Nicholson Cost Accounting	☐ Railway Mail Clerk
☐ Bookkeeping	☐ Common School Subjects
☐ Private Secretary	☐ High School Subjects
☐ Spanish ☐ French	☐ Illustrating

TECHNICAL AND INDUSTRIAL COURSES

☐ Electrical Engineering	☐ Architect
☐ Electric Lighting	☐ Architects' Blue Prints
☐ Mechanical Engineer	☐ Contractor and Builder
☐ Mechanical Draftsman	☐ Architectural Draftsman
☐ Machine Shop Practice	☐ Concrete Builder
☐ Railroad Positions	☐ Structural Engineer
☐ Gas Engine Operating	☐ Chemistry ☐ Pharmacy
☐ Civil Engineer	☐ Automobile Work
☐ Surveying and Mapping	☐ Airplane Engines
☐ Metallurgy ☐ Mining	☐ Agriculture and Poultry
☐ Steam Engineering ☐ Radio	☐ Mathematics

Name.....
Street Address.....
3-6-24
City.....State.....
Occupation.....

Persons residing in Canada should send this coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada

"WONDER" Cold Pipe and Tubing Benders
Do Not Crack, Flatten or Crimp the Pipe

Hand and Motor Operated
14 SIZES OF MACHINES

What it Costs to Bend Pipe Our Way. Per Bend
1" Pipe - 5c 4" Pipe - 25c
2" Pipe - 10c 6" Pipe - 60c
8" Pipe - $1.00

Send for Catalogue

American Pipe Bending Machine Co., 51 Pearl St., Boston, Mass.

Patents—Trade Marks
S. T. WALKUP
Registered Patent Attorney
Counsel for Attorneys
Consulting Mechanical and Electrical Engineer
Patents and Inventions Appraised
WOOLWORTH BUILDING :: NEW YORK CITY

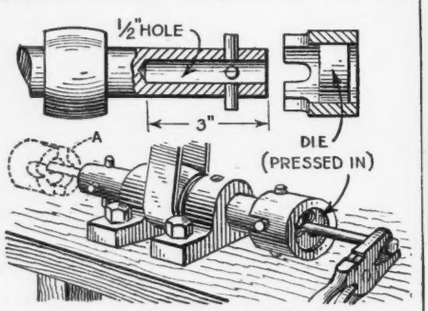
Better Shop Methods

Cheaply Made Bench Machine Threads Small Work Rapidly

A SIMPLE threading machine that saves time in cutting threads on small work is illustrated. With it many odd jobs of threading can be done more conveniently and quickly than by putting them in the lathe.

Two pillow-block bearings are bolted to the bench to take a shaft, which is fitted with a pulley and drilled at each end for four pins. These pins engage the four projections on a die-holder made of pipe. The speed should be about 250 revolutions a minute.

To thread bolts or rods, the bolt is gripped in a pair of pliers and the end



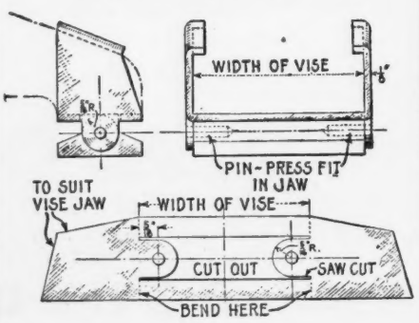
One end of the shaft runs the threading die on; the other turns it off

pressed into the die as shown. When the desired length has been threaded, the rod or bolt is drawn from the shaft, taking with it the die-holder. This, of course, stops the die-holder from rotating. The shaft never stops.

To run the die off the bolt, it is placed on the left-hand end of the shaft, as shown at *A*, the rod or bolt being held with the pliers as before.

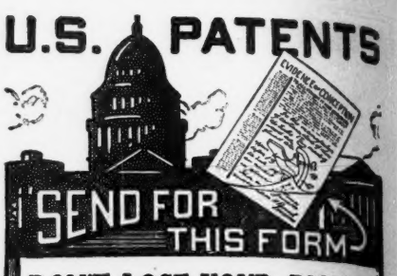
With a little practice threads may be cut rapidly and accurately. The cost of the machine is small, in this case being only $1.50 for material and a few hours' work.—H. E. B.

Constructing Swivel Vise Jaws to Hold Tapered Work



THE swivel vise jaw shown in detail above is one that has proved satisfactory for general work. The construction is so simplified that the cost is insignificant compared to the time it saves and the many uses to which it can be put.

This design may be modified to fit a vise of any size or style. The jaws are of steel and are made in pairs.—WALTER LYON, Milwaukee, Wis.



DON'T LOSE YOUR RIGHTS
TO PATENT PROTECTION

Before disclosing your invention to anyone send for blank form **"EVIDENCE OF CONCEPTION"** to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish the same before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the United States and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception," sample, instructions relating to obtaining of patents and schedule of fees sent upon request. Ask for them,—a post card will do.

PATENTS AND TRADE MARKS
LANCASTER & ALLWINE
Registered Patent Attorneys in U. S. and Canada
274 Ouray Bldg.
WASHINGTON, D. C.
Originators of forms "Evidence of Conception."

PATENTS

To the Man With an Idea

I offer a most comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts, frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

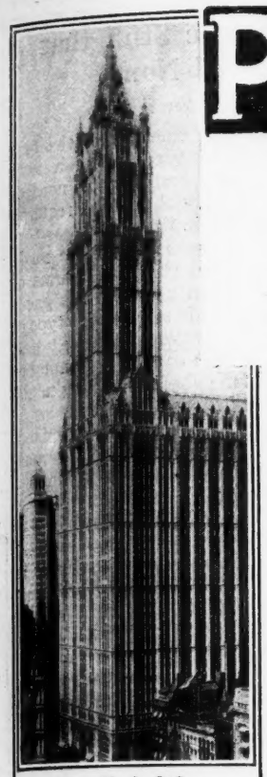
Booklet of valuable information and form for properly disclosing your idea, free on request. Write today.

RICHARD B. OWEN
Patent Lawyer
6 Owen Building, Washington, D.C.
41-D, Park Row New York City

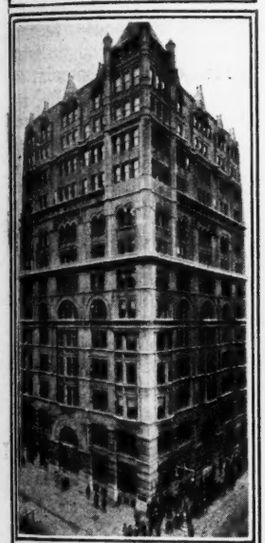
INVENTIONS Commercialized
ON A CASH OR ROYALTY BASIS
For the INVENTOR and MANUFACTURER
In Business 25 Years · Complete Facilities · References
ADAM FISHER MFG. CO. 183-D ST. LOUIS, MO.

Mason, Fenwick & Lawrence
Patent and Trade Mark Lawyers
Washington, D. C. New York Chicago
Established over 60 years *Write us*
Inventions Protected Trade Marks Registered

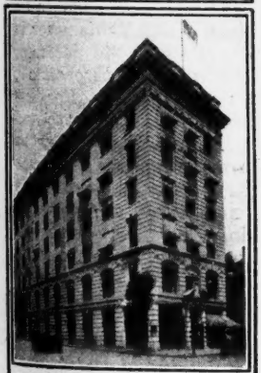
PATENTS TRADE-MARKS AND COPYRIGHTS



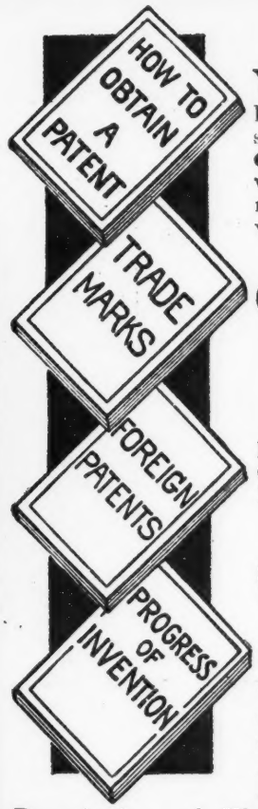
New York Office
Suite 1007 Woolworth Bldg.



Philadelphia, Pa., Office
Suite 714-715 Liberty Bldg.



Washington, D. C., Office
Victor Bldg.



OUR OFFER:

Your first step

Before disclosing an invention the inventor should write for our blank form **"RECORD OF INVENTION."** This should be signed, witnessed and returned to us together with model or sketch and description of the invention for **INSTRUCTIONS.**

NO CHARGE FOR THE ABOVE INFORMATION

Our Four Books Mailed Free to Inventors

Our Illustrated Guide Book

HOW TO OBTAIN A PATENT

Full instructions regarding U. S. Patents. Our Methods, Terms, and 100 Mechanical Movements illustrated and described.

OUR TRADE MARK BOOK

Shows value and necessity of Trade Mark Protection. Information regarding *Trade Marks and unfair competition in trade.*

OUR FOREIGN BOOK

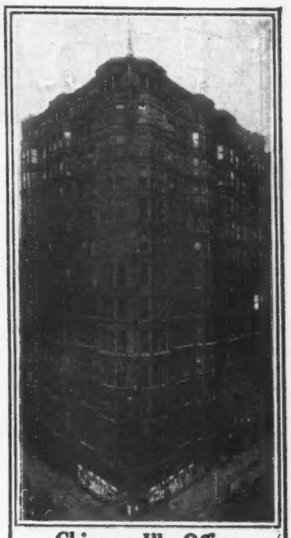
We have Direct Agencies in Foreign Countries, and secure Foreign Patents in shortest time and at lowest cost.

Progress of Invention

Description of World's Most Pressing Problems by Leading Scientists and Inventors

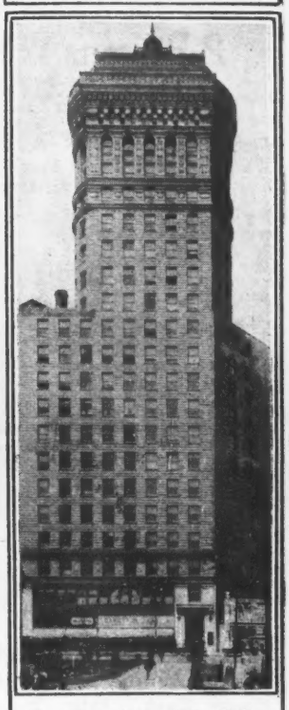
ALL COMMUNICATIONS AND DATA STRICTLY CONFIDENTIAL INTERFERENCE AND INFRINGEMENT SUITS PROSECUTED

Private Office, Victor J. Evans, with View of Patent Office Through Window



Chicago, Ill., Office
Suite 1114 Tacoma Bldg.

Pittsburgh, Pa., Office
Suite 514, Empire Bldg.



San Francisco, Cal., Office
Suite 1010 Hobart Bldg.

Highest References Prompt Attention Reasonable Terms

VICTOR J. EVANS & CO., Patent Attorneys

Main Offices: 760-9th Street, N. W., Washington, D. C.

FREE COUPON

Gentlemen: Please send me FREE OF CHARGE your books as described above.

Name.....

Address.....

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

PATENTS

TRADE-MARKS
DESIGNS
FOREIGN PATENTS

MUNN & CO.

PATENT ATTORNEYS

Associated since 1846 with the Scientific American

683 WOOLWORTH BUILDING
New York City

522 SCIENTIFIC AMERICAN BLDG.
Washington, D. C.

411 TOWER BUILDING
Chicago, Ill.

364 HOBART BUILDING
San Francisco, Cal.

219 VAN NUYS BUILDING
Los Angeles, Cal.

Books and Information on Patents
and Trade Marks By Request.
Associates in All Foreign Countries.

Bossert-Built Houses Can Be Erected By 2 Persons Within Few Days' Time

From Homes to Summer Bungalows We Have the Type You Want. No Delay or Waste in Erection!

There is a Bossert House for every need. Whether it is a substantially constructed home for all-year use, or a cozy little bungalow for your summer weeks at the seashore or in the mountains, Bossert has the type that exactly meets with your requirements.

Every Bossert Sectional House is *built* at our plant by experienced and highly skilled builders. The house is delivered to you either *sectional* or *ready-cut* as desired, complete with plans and specifications; millwork; plasterboard (when specified); hardware; paint and varnish. Architect's fees, builder's wastes, and construction delays are eliminated. Because you deal directly with one of the oldest and largest lumber plants in the East you are guaranteed highest quality and complete satisfaction with lowest prices.

We have a handsomely illustrated catalogue of Bossert houses which we will be glad to send you free upon receipt of your address. Write us TODAY.

Consult Bossert first for: Homes, Summer Bungalows, Club Houses, Garages, Church Buildings, Hospitals and Additions.

Louis Bossert & Sons, Inc.
Largest Lumber Plant in the East
(House Dept.) 1310 Grand Street
BROOKLYN, N. Y.

MORE DISTANT STATIONS

WITH THE APEX VERNIER DIAL

Greater range, bigger volume, finer selectivity, less interference. Lasts forever. The one big advance yet made in tuning. Ratio 12 to 1.

Quickly applied to any shaft.

For sale by all good Radio Dealers.

If unable to obtain from dealer, enclose

$2.00 for Royal Brass Finish.

$2.50 for Satin Silver Finish.

$3.50 for De Luxe Gold Plated Finish.

The Apex Super Five

is a tuned radio frequency receiver of the highest type. Built into a highly finished walnut cabinet — complete with Jones Multiple Battery Cable—all settings highly gold plated. List price $95.00 complete.

7 Tube Microdyne Super-Heterodyne for $97.50

Receive the parts complete to assemble your set. Coast to coast on an 18 in. loop. Assemble this 7-tube Microdyne Super-Heterodyne on a 7 x 18 in. panel in 3 hours. Parts complete. Price of cabinet, to fit, on application. If your radio dealer cannot supply, send check or money order and name of dealer.

Apex Electric Mfg. Co.
1410 W. 59th Street Dept. 403 Chicago

The Magic Stuff that Saved Nome

(Continued from page 29)

convert them into vaccines of the first order. These are used where a very quick immunizing response is needed. They shorten greatly the period required for preventive immunization.

Bacterins and serobacterins are made mostly from several strains of germs of each disease. When a person has pneumonia, for example, it may be one type of this infection out of several possible types; or it may have been caused by a number of mixed strains. The same thing might apply to cases of blood poisoning.

The infections are commonly mixed. Therefore it is vital, at times, that serums contain antibodies effective against a number of mixed strains.

THE bacteria used to produce these products come from typical cases in hospital and private practice all over America. The specimens are examined by bacteriologists for identification, and the various strains or types are selected and cultured.

One of the important developments of immunology was the discovery that susceptibility to various diseases—diphtheria among them—could be told by skin tests made by injecting preparations of disease germs between the layers of the skin. In this way the presence or absence of sufficient natural specific antibodies in the blood could be determined through slight inflammation or lack of it, at the point of inoculation.

Thus experiments were begun to learn why a few children never contracted diphtheria, although exposed. The reason was found in the antibodies in their blood. This led to the Schick test, by which the immune children could be picked out. It led also to the development of the toxin-antitoxin immunization, which makes susceptible children safe from diphtheria.

DIPHTHERIA, by the way, is peculiarly a disease of children. Very young infants usually are immune, it being believed that antitoxin from their mothers' blood passes into their bodies before birth. The highest degree of susceptibility lies between the ages of one and two, when only 30 per cent of children are immune. After the age of three the number of children contracting the disease falls off rapidly.

Why, though, should some children be immune and others not? The answer is that repeated exposures to disease, coupled with the strength to throw it off, gradually build up immunity. For this reason city children, constantly exposed to slight infections, are less a prey to diphtheria and similar infectious diseases than are country children. For this reason, young men from the crowded tenements during the war stood up against disease ravages where men from homes in sparsely settled sections went down easily. For this reason, too, an isolated community such as Nome is in particular danger from epidemics of diphtheria, and the danger is heightened

(Continued on page 139)

Ⓢ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

The Magic Stuff that Saved Nome

(Continued from page 138)

because medical supplies and medical skill are likely to be lacking.

The latest development with diphtheria antitoxin is in a super-concentrated form, the result of years of experiment to separate the antitoxin substance from the horse-blood serum in which it is produced. This was the sort of antitoxin that was carried into Nome—an explanation of the fact that 300,000 units could be compressed into a package, which, with its wrappings, weighed only 20 pounds.

The modern antitoxin not only is less bulky than the serum of former years, but is correspondingly more potent and more easily and quickly administered, without the suffering once forced on the patient.

AMONG outstanding recent developments is the fact that scarlet fever, perhaps the most troublesome of children's diseases, at last seems to have been brought to control and prevention by the discoveries of Drs. George and Gladys Henry Dick, of Chicago, and of former workers.

The Dicks produced experimental scarlet fever in human volunteers through the use of cultures of various strains isolated from scarlet fever cases. After producing this disease, they demonstrated that susceptibility to scarlet fever could be determined by skin inoculation, as in diphtheria.

It is believed, though not positively demonstrated, that scarlet fever is caused by certain specific strains of the streptococcus, the deadly bacterium that causes blood poison of different types.

Seventy-four per cent of the deaths from scarlet fever occur in children under 10, and survivors frequently develop later trouble due directly to this malady.

Again, as in diphtheria, it is probable that the natural immunity from scarlet fever, acquired by many, is a contact immunity, brought about by repeated exposures and mild infections. In a private school, with students from protected homes, 85 per cent were found susceptible to scarlet fever, while in a public school in New York City only 22 per cent were susceptible.

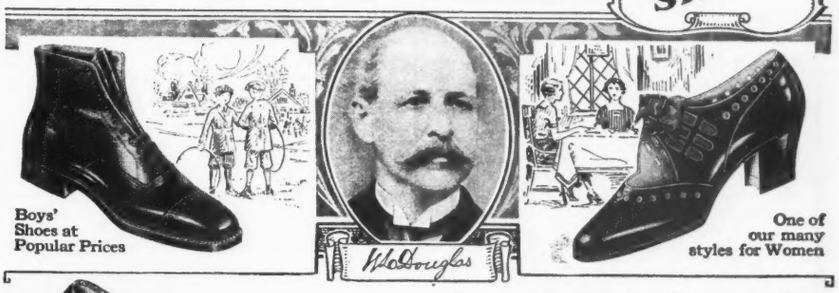
The means now are readily available not only for carrying out the Dick test, but for applying the immunizing treatment to those susceptible, and for administering the scarletinal antitoxin to those manifesting symptoms.

THE germ of scarlet fever is thought to be only one strain of the streptococcus bacterium. Other strains of this organism are responsible for serious diseases, including blood poisoning, erysipelas, and childbirth fever. Science has found a way to produce a serum containing antibodies capable of antagonizing or neutralizing a wide variety of these strains, and recent advances have improved the activity or potency of this serum.

Experiments with antistreptococcus (blood poison) serum in smallpox cases

(Continued on page 140)

W·L·DOUGLAS $5 $6 $7 & $8 SHOES



Boys' Shoes at Popular Prices

One of our many styles for Women

One of our many popular Young Men's models. In Black Velour and Light Russia Calf

Smart Styles for Young Men

See the new styles ready for you this Spring and remember that there is sure economy in buying W. L. Douglas Shoes.

W. L. Douglas' name and the retail price is stamped on the sole of every shoe at the factory.

We own and operate 120 Retail Shoe Stores in the principal cities. W. L. Douglas shoes are also sold by over 6000 retail shoe dealers.

W. L. DOUGLAS SHOE CO.
Brockton, Mass.

$25.00 in PRIZES
See top page 8 in front of book for details

For your home shop!
PARKS
Cabinet Shop Special
$225
with all attachments and motor

HERE'S an all-round woodworker for the small shop. Sturdy, fast and true. The biggest little woodworker ever built. Saw table has 8-in. rip and cross-cut saw, and 4-in. jointer and borer. You can choose from these extra attachments: band saw; shaper; sander; lathe; and motor. Send for Bulletin C-S and complete Parks catalog.

The Parks Ball Bearing Machine Company
1547 Knowlton St., Cincinnati, O.
Canadian Factory: 203 Notre Dame East, Montreal, Can.

PARKS
WOODWORKING MACHINES

Give Cheer to the Sick Room with

Cunningham RADIO TUBES

THOSE endless hours that used to drag by so heavily now trip past on dancing feet. The pain, the discomfort is forgotten. Over the air come those unseen, lightning-like impulses which your receiving set, equipped with Cunningham Tubes, turns into glorious sound.

Since 1915
Standard for All Sets

Types C-301A, C-299, C-300, C-11, C-12.
In the Orange and Blue Carton

Patent Notice: *Cunningham tubes are covered by patents dated 2-18-08, 2-18-12, 12-30-13, 10-23-17, 10-23-17, and others issued and pending.*

Cunningham 40-page data book fully explaining care and operation of Radio Tubes now available by sending 10c in stamps to San Francisco Office.

E. T. Cunningham Inc.

HOME OFFICE
SAN FRANCISCO CHICAGO NEW YORK

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

What Will Rogers does between acts

WHEN he's not amusing folks on the stage of The Follies, Will Rogers has other ways of turning minutes into money.

With his Corona, in his dressing room, he turned out his famous book, "The Illiterate Digest"—the best selling book of humor of the year.

* * * *

That's the advantage of owning a Corona. You can use it anywhere, any time—make something of the spare moments most people squander.

By the way, have you seen the New Corona Four? It has a full-size standard keyboard, the same as big office machines, yet it is portable.

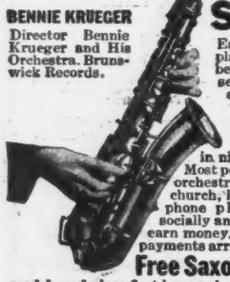
Corona Four costs only $60. Easy terms if desired. Look for Corona in your phone book or write Corona Typewriter Co., Inc., 112 Main St., Groton, N. Y.

CORONA

Easy to Play
Easy to Pay

BUESCHER True-Tone Saxophone

BENNIE KRUEGER
Director Bennie Krueger and His Orchestra. Brunswick Records.



Easiest of all instruments to play and one of the most beautiful. Three first lessons sent free give you a quick easy start—in a few weeks you can be playing popular tunes. No teacher necessary. You can take your place in a band or orchestra in ninety days, if you so desire. Most popular instrument for dance orchestras; home entertainments, church, lodge and school. A Saxophone player is always popular socially and has many opportunities to earn money. Six Days' Trial and easy payments arranged. (105)

Free Saxophone Book Shows all Buescher models and gives first lesson chart; also pictures of famous professionals and orchestras. Just send your name for a copy. Mention any other instrument in which you may be interested.

BUESCHER BAND INSTRUMENT CO.
Everything in Band and Orchestra Instruments
703 BUESCHER BLOCK • • ELKHART, INDIANA

The Magic Stuff that Saved Nome

(Continued from page 139)

are reported to have shortened the course of the disease and prevented pitting and secondary infections. In erysipelas, streptococcus pneumonia, streptococcus complications in scarlet fever, and in other infections, this serum has brought marked advances in medicine.

This serum also has been experimented with in the treatment of pernicious anemia. One theory regarding this little understood disease attributes it to auto-intoxication of intestinal origin.

Autointoxication, or deterioration of the powers of the blood through the absorption of poisonous matter not properly eliminated, is one of the commonest of ailments that make life miserable and ultimately kill. Wrong diets or sedentary habits cause bacteria to infest the intestines, and the toxic substances that result give rise to ailments that are hard to fathom. Medical research in this direction has produced artificially the acidophilus bacillus, which in normal health flourishes in the intestinal tracts and destroys enemy bacteria.

PNEUMONIA is a peril that we all face. This disease, claiming one-tenth of all who die from infancy to old age, may never be conquered altogether, but extraordinary work has been done in its subjugation. Some years ago a pneumonia serum was produced from the blood of horses inoculated with pneumonia bacteria. This serum, though successful, contained protein matter from the horses' blood that caused harmful reactions in the patient. Also, lacking hospital facilities, the ordinary practitioner was unable to use it.

Recently, however, Dr. Frank W. Huntoon succeeded in taking the antibodies out of the serum entirely and suspending them in a clear water solution. This pneumonia antibody has been used with considerable success and has sufficed to cut down somewhat the reactions that ordinarily followed use of the horse serum. There are mixed serobacterins, too, useful in preventing or treating common colds and bronchitis.

Next to pneumonia and tuberculosis, typhoid fever is the most deadly of diseases, attacking fully half a million persons in the United States every year, of whom every seventh person dies.

YET in the armies of the world typhoid has been wiped out by the discovery of immunization, and it would disappear from civilian life if inoculation were to be practised universally. The average duration of immunity is 30 months. Occasionally one injection of typho-bacterin prevents an attack of typhoid fever. The immunization is harmless to healthy persons, and confers almost absolute immunity.

I should mention, too, the development of a vaccine against hydrophobia, the marvelous work of the lockjaw antitoxin, which has eliminated this disease from the armies of the world as a cause of death, and the experiments with the control of whooping cough and meningitis.

YOU TOO CAN PLAY THE HAWAIIAN GUITAR
JUST AS THE HAWAIIANS DO
PLAY ALL THE LATEST HITS

FREE! THIS $15. HAWAIIAN GUITAR

ONLY 4 MOTIONS used in playing the fascinating Hawaiian Guitar. Our native Hawaiian instructors teach you to master them quickly. Pictures show how. Everything explained clearly.

PLAY IN HALF HOUR After you get the 4 easy motions, you can play harmonious chords with very little practice. 40,000 students have learned to play in this easy, pleasant way.

EASY LESSONS The 52 printed lessons with a great many pictures make it easy to learn quickly. You don't have to know how to read notes. No previous musical knowledge necessary. You learn to play any kind of music, and pay as you play.

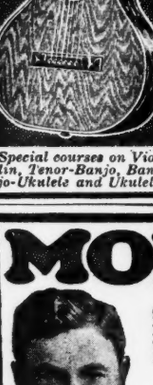
FREE GUITAR As a special offer to new students we give this full size, high grade instrument free of charge. It is sent at once without red tape or delay.

WRITE AT ONCE Send your name at once and let us tell you all about the 52 easy lessons and the free guitar. You have everything to gain. Don't put it off. A post card will do. Ask for new special offer and easy terms.

Special courses on Violin, Tenor-Banjo, Banjo-Ukulele and Ukulele

First Hawaiian Conservatory of Music, Inc.
233 Broadway (Woolworth Bldg.) Dept. 46, New York, N. Y.

MONEY



You too can now earn $100 to $250 a Week
I'll train you—in your spare time. Be a Master Salesman

I'll make you a Master Salesman. I guarantee it. Selling offers you amazing opportunities—$4,000 to $15,000 a year. No other line offers so many jobs—such big money.

You Can Learn to Sell. Don't think you can't. I'll show you how—quickly and easily. My Selling Course, positively best money can buy.

FREE Book. Clip coupon now for the greatest book of your life—"The Right Way to Sell".

Jas. P. Ward, Gen. Sales Mgr.
"The Man Who Makes Money-Makers"

JAS. P. WARD, General Sales Manager,
Manufacturers Sales Corporation of America,
5044 Administration Bldg.,
1774-1790 Montrose Ave., Chicago, Ill.
Dear Sir: Send me at once your Free Book—"The Right Way to Sell."
Name.....
Address.....
Occupation.....

FORDS—Start Easy at Zero
Nearly double mileage
50% More Power

The AIR FRICTION is the ONLY Carburetor which changes ordinary gasoline into powerful, super-heated DRY GAS VAPOR which burns up clean, prevents carbon and nearly doubles power and mileage. Leaves no unburned gasoline to run down into crankcase, destroy lubrication and grind out bearings. Motors live two to three times as long with Air Friction. Fords guaranteed to make 34 miles to gallon. Other cars in proportion. Try Air Friction 30 days at our risk. Money back if you want it. Agents wanted. Write today.

AIR-FRICTION CARBURETOR COMPANY
1519 Raymond Building Dayton, Ohio, U. S. A.

Print Your Own

Cards, stationery, circulars, labels. Presses $12 up. Paper Cutters $3 up. Save money. Print for others, big profit. All easy, rules sent. Write for catalog presses, type, paper etc. THE PRESS CO., F-33. Meriden, Conn.

LATEST WHOLESALE RADIO CATALOG FREE

Simply send name TODAY for big 48-page catalog of latest radio goods at Wholesale. *Live dealers and agents wanted.*

STANDARD RADIO CO., 104 East 13th, Kansas City, Mo.

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

Why the Eclipse Was Late

(Continued from page 39)

already it is beginning to change from the graceful, symmetrical form it holds at the maximum sunspot period to the shorter, brighter form that marks the minimum period.

"Also, photographs made with a camera of 17-inch focal length showed the corona to extend 2,000,000 miles into space. Our largest camera, the focal length of which was 62.5 feet, did not show this amazingly great extension of the corona rays for the reason that its lens was not fast enough to record the exceedingly rapid passage of light through this enormous distance.

"WITH the large camera, however, we obtained images of the moon 7¼ inches in diameter, which is on a scale large enough to work out the details of the structure of the corona. This is the principal topic of inquiry at all eclipses, of course, for the corona—the fiery halo of the sun—is seen only at such times.

"Photographs made with cameras of various focal lengths will enable us to determine the laws of distribution of the materials making up the corona.

"We used also two interferometers to determine the distribution of the gases in the corona and also the motion of the gases, our chief hope being to determine whether the corona rotates with the sun in much the same way as our atmosphere rotates with the earth.

"We employed a small spectroscope to find out the relative brightness of the various gases in the corona, and two large spectroscopes in an endeavor to determine what is the distribution of the metallic vapors immediately above the sun.

"Investigations of this sort are of prime interest to the astronomer; of little interest, though, to the layman, to whom an eclipse simply is a splendid spectacle. The spectacular features of an eclipse escape the scientific observer almost entirely. That has been my experience, at any rate.

"AT THE recent eclipse, for example, the amount of spare time I had during the two minutes of totality was exactly 15 seconds. During the rest of the time I was exposing photographic plates, or making ready for the next exposure. Some day, though, I may get an opportunity really to *see* an eclipse.

"As in other expeditions, we set up a camera also to determine accurately the photographic diameter of the moon as a check on the Einstein theory. We know the distance of the moon from the earth, and we are able to compute its diameter. Photographs obtained with this instrument, which has a focal length of 15 feet, may enable us to ascertain whether the photographic diameter of the moon checks with its computed diameter. Many scientists believe it will not; that the photographic diameter is larger. If they are right, it will show that some force other than that assumed by the Einstein theory is the cause of the deflection of the light of the stars that are nearly on the same line as the sun.

"That the eclipse was late in arriving

(Continued on page 142)

$542.00 Earned IN ONE MONTH

A New Business—Big Business

A Business to Enthuse Over — The "Ideal" Lawn Mower Sharpener

A wonderful invention that sharpens lawn mowers scientifically—quickly—perfectly; does the work as nothing else can.

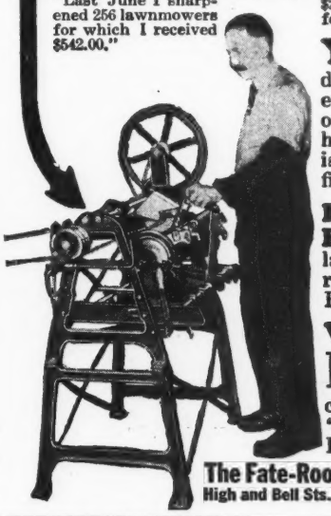
FRED C. MILKERT OF ROSELLE, ILL., WRITES: "The Ideal Lawn Mower Sharpener put me in business, starting in the basement of my home and forcing me now for the third time to move into bigger quarters. Today the dream of my life—a shop of my own—is realized. With a machine like yours and a little hustle any man can have a business of his own and be independent."

D. H. NOAKES, MILFORD, OHIO, WRITES: "Several years ago I started sharpening mowers in a 10 x 10 shed. Today I own a store of my own on Main Ave., No. 212, valued at $8,000.00. The 'Ideal' Grinder did it all."

FRED MILKERT, Roselle, Ill. writes: "Last June I sharpened 256 lawnmowers for which I received $542.00."

W. F. KENDT, BUFFALO, writes: I sharpened 994 lawnmowers last season, and the receipts were nearly $2100.00 which is not bad for a side line."

ZENO BRANDON, MIDDLETOWN, OHIO, writes: "I made $820.70 in 55 days with my 'Ideal.' Have made as high as $38.70 in one day."



You Start Now No town too small. Lawn mowers are dull—owners don't know where to get them sharpened. Mowing the lawn dreaded because of dull or improperly sharpened mower. Lawn mowing healthful, invigorating and pleasant when Mower is "Ideally" sharpened. You do the work scientifically—you are in big demand.

Lawn Mowers Sharpened to Razor Edge— People glad—owners delight in mowing lawn with mower sharpened on an "Ideal." Mower runs light—click-click-click and the grass is cut. Build permanent business for yourself. Start now!

WRITE TODAY

Free —Detailed illustrated catalog and booklet "Let George Say It." Write today.

The Fate-Root-Heath Co.
High and Bell Sts., Plymouth, O.

USE THIS—MAIL IT TODAY
The Fate-Root-Heath Company
High and Bell Sts., Plymouth, O.
Please mail at once free Illustrated Catalog and booklet "Let George Say It."

Name .....
Address .....
.....

A TEST EVERY MAN PAST 40 SHOULD MAKE

Medical authorities agree that 65% of all men past middle age (many much younger) are afflicted with a disorder of the prostate gland. Aches in feet, legs and back, frequent nightly risings, sciatic pains, are some of the signs—and now, a member of the American Association for the Advancement of Science has written a remarkably interesting Free Book that tells of other symptoms and just what they mean. No longer should a man approaching or past the prime of life be content to regard these pains and conditions as inevitable signs of approaching age. Already more than 20,000 men have used the amazing method described in this book to restore their youthful health and vigor—and to restore the prostate gland to its proper functioning. Send immediately for this book. If you will mail your request to the Electro Thermal Company, 4044 Main Street, Steubenville, Ohio—the concern that is distributing this book for the author—it will be sent to you absolutely free, without obligation. Simply send name and address. But don't delay, for the edition of this book is limited. Western Office, Dept. 40J, 711 Van Nuys Bldg., Los Angeles, Calif.

AMBASSADOR
Low Loss Products

Master Tuning Coil
Perfectly Balanced Head Phone
Low Loss Condenser

High grade, standard radio products that will increase the efficiency of any set and add to the satisfaction of the user. Ambassador Low Loss Products have long been the choice of particular fans. See them—compare them, and you will choose them too.

At all good dealers

Write for FREE circuit diagrams in which Ambassador products can be used.

AMBASSADOR SALES COMPANY
108 Greenwich St., New York
326 W. Madison St., Chicago

Why BOSTON?

Because it has exclusive features

ALL Rubber Oblong Button, holds stockings taut—for trim ankles.

Hook and Eye Cast-off—for convenience.

Slide Adjustment—for fit and comfort.

No metal parts on face of pad —no wrinkles.

The pad without a pucker.

GEORGE FROST COMPANY, Makers, BOSTON

HOW DID YOUR GARTERS LOOK THIS MORNING?

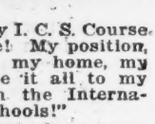
This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

$95 an Hour!

"Every hour I spent on my I. C. S. Course has been worth $95 to me! My position, my $5000 a year income, my home, my family's happiness—I owe it all to my spare-time training with the International Correspondence Schools!"

Every mail brings letters from some of the thousands of I. C. S. students telling of promotions or increases in salary as the rewards of spare-time study.

What are you doing with the hours after supper? Can you afford to let them slip by unimproved when you can easily make them mean so much? One hour a day spent with the I. C. S. will prepare you for the position you want in the work you like best. Yes, it will! Put it up to us to prove it.



Mail the Coupon for Free Booklet

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 7646-D, Scranton, Penna.

Without cost or obligation, please send me one of your booklets and tell me how I can qualify for the position or in the subject *before* which I have marked an X:

BUSINESS TRAINING COURSES

☐ Business Management	☐ Salesmanship
☐ Industrial Management	☐ Advertising
☐ Personnel Organization	☐ Better Letters
☐ Traffic Management	☐ Show Card Lettering
☐ Business Law	☐ Stenography and Typing
☐ Banking and Banking Law	☐ Business English
☐ Accountancy (including C.P.A.)	☐ Civil Service
☐ Nicholson Cost Accounting	☐ Railway Mail Clerk
☐ Bookkeeping	☐ Common School Subjects
☐ Private Secretary	☐ High School Subjects
☐ Spanish ☐ French	☐ Illustrating

TECHNICAL AND INDUSTRIAL COURSES

☐ Electrical Engineering	☐ Architect
☐ Electric Lighting	☐ Architects' Blue Prints
☐ Mechanical Engineer	☐ Contractor and Builder
☐ Mechanical Draftsman	☐ Architectural Draftsman
☐ Machine Shop Practice	☐ Concrete Builder
☐ Railroad Positions	☐ Structural Engineer
☐ Gas Engine Operating	☐ Chemistry ☐ Pharmacy
☐ Civil Engineer	☐ Automobile Work
☐ Surveying and Mapping	☐ Airplane Engines
☐ Metallurgy ☐ Mining	☐ Agriculture and Poultry
☐ Steam Engineering ☐ Radio	☐ Mathematics

Name.....
Street Address.....
3-6-24
City.....State.....
Occupation.....

Persons residing in Canada should send this coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada

"LIBERTY" ELECTRIC SOLDERING IRON
Guaranteed For One Year
$1.25 *each* Postpaid
Equipped with Finest Quality Heating Element. Has Separable Plug, Six Foot Cord and Removable Copper Tip. Handy for Home, Radio and Electric Jobs. 110-120 Volts, A C or D C.
Russell B. Cressman, 200 Fifth Ave., N. Y. City, Dept. "S"

HONEYCOMB COILS
The Universal all-wave inductance. Back and front panel mountings. Send 25c for Super Het., R. F. and Honeycomb Coil Circuits and Complete Catalog.
Chas. A. Branston, Inc.
Dept. 9,
815 Main St. Buffalo, N. Y.

Why the Eclipse Was Late

(*Continued from page 141*)

at the various stations occasioned considerable comment. There is nothing extraordinary, however, in this. In the five eclipses that I have observed, some were late, others early. The reason for this is that we do not know the orbit of the moon with extreme accuracy, and therefore cannot compute with entire accuracy the width and length of the shadow.

"The size of the shadow depends on the relative distances between the sun, the moon, and the earth. The orbit of the moon is influenced not only by the gravitational attraction of the earth and the sun, but by several other planets, and just how much this deflects it in its orbit we cannot determine. If the shadow of the moon is slightly smaller than is computed, the eclipse will be late, as was the case with the recent one. If it is slightly larger, it will be early. An unavoidable error of only part of a mile will cause the eclipse to arrive either late or early. When we consider with what vast distances astronomical calculations are concerned, an error of part of a mile is not particularly great.

"THIS latest eclipse may bring us somewhat closer to solving the mystery of shadow bands—those amazing and elusive plays of light and shadow that many persons saw on the snow. We attempted to photograph them with a high-speed motion-picture camera in order to determine accurately their direction and velocity, but they eluded our camera.

"I understand, though, that moving pictures of the shadow bands were made successfully at the Wesleyan University observatory, Middletown, Conn.

"Since the eclipse several possible explanations of the shadow bands have been offered, some quite tenable, including the conventional explanation that they are due to heat motion in the air.

"Some substantiation for this theory seems to be offered by the fact that, while the shadow bands were clearly observed on the ground, they were not seen on the wings of airplanes. The speed with which the airplanes were moving, though, rather than the low temperatures in which they moved, may have been the cause of this.

"WITH the radio tests our expedition was not actively concerned. The results of these tests, so far as I have been able to learn, seemed more or less inconclusive. In some places radio reception was reported to have improved during the darkness of totality; in other places listeners reported no difference.

"Photographs of the eclipse made from the air were for the most part of scant value to science for the reason that the rapid motion of the planes caused distortion in the pictures. Perfect definition would have necessitated that the plane be at rest, absolutely immovable, at the time each photograph was taken. Possibly a method of bringing this condition about may be developed in the future. Also, improved photographic apparatus some day may make it possible to photograph the moon's shadow from the air and thus fix its path with absolute accuracy."

Catch Fish Fels, Mink, Muskrats and other animals in large numbers with our new folding galvanized STEEL WIRE TRAP It catches them like a fly trap catches flies. Write for our FREE TRAP OFFER, Bargain Catalog of Fishing Supplies & Formula on best Bait known for catching all kinds of fish.
WALTON SUPPLY CO. Dep. 144 St. Louis, Mo.

Mr. Brush Salesman Unusual opportunity is offered for aggressive, ambitious, hustling men to represent an old established manufacturer of high grade, guaranteed, fastest selling line of Sanitary Twisted in Wire Brushes, sold direct to the Home. We have openings for experienced brush men as managers in all territories. We want live wire, energetic Go-Getters. We pay larger commissions than any other Brush House in the Country. If you want to earn some real money, it will pay to write us immediately for our proposition. WIRE GRIP SANITARY BRUSH CORP., 15 Mercer Street, New York City.

fishermen get this book
Fishing facts and hints. Tells how to compete in our annual $2,000 Fish-Photo contest. A postal gets it FREE!
SOUTH BEND BAIT COMPANY
14579 High Street South Bend, Ind.

Squab Book FREE

Squabs selling at highest prices ever known. Greatest market for 20 years. Make money breeding them. Raised in one month. We ship everywhere our famous breeding stock and supplies. Established 24 years. Write now for big illustrated free book, How to Make Money Breeding Squabs.
PLYMOUTH ROCK SQUAB CO.
616 H St., Melrose Highlands, Mass.

BURN YOUR NAME ON TOOLS WITH ARKOGRAF

Protect your tools from theft. Write any name, engrave any design on tools and metal with electricity like writing on paper with pen or pencil. Complete outfit $3.50, prepaid anywhere. Interesting descriptive circulars free. Write to-day. Agents wanted.
Arkograf Pen Co., 1171-A East Stark St., Portland, Oregon

MAKE MONEY SELL MADISON SHIRTS
Direct from our factory to wearer.
Easily sold. Over one million satisfied wearers. No capital or experience required. Large steady income. Many earn $100. to $150. weekly. Territory now being allotted. *Write For Free Samples.*
MADISON SHIRT M'F'RS, 505 Broadway, New York

BUCHSTEIN'S FIBRE LIMB
is soothing to your stump—strong, cool, neat, light. Easy payments.

Guaranteed 5 Years
Send for Catalog Today
Braces for all deformities
P. BUCHSTEIN CO., 610-3rd Ave., So. Minneapolis, Minn.

CLASS 25¢ PINS
BUY DIRECT FROM THE MAKER
CATALOG FREE

Either pin shown made with any 3 letters and 2 figures. 1 or 2 colors enamel. Silver plate 25¢ ea. $2.50 doz. Sterling silver. 40¢ ea.. $4.00 doz.
BASTIAN BROS. CO.
591 Bastian Bldg., Rochester, N. Y.

Agents Make $200 to $500.00 Per Month

Instant weld
new scientific principle.
Without heat or cement quickly repairs punctures or blow outs.
Money back guarantee. Get wise to this new seller, every auto owner a prospect. Exclusive territory. Write for FREE sample and full details.
TOURIST PRIDE MANUFACTURING CO.
Desk 45C MINNEAPOLIS, MINN.

The Taming of Dynamite

(Continued from page 34)

high explosives, but the explosives manufacturer has been driven to look for cheaper materials as well adapted as natural sugars to his requirements. He has asked the research chemist to prepare specialized types of sugars—sugars not sweet to the taste, but that lend themselves to the production of explosive compounds.

"In fact, the chemist has gone back to the elements of nature—air and water—as the starting point of many new compounds. This meticulously careful investigation has brought about the cheapness of modern high explosives. The traveler on the railroad today rides for a lower rate, and the motorist pays lower taxes for building his good roads, because the tunneling, ballasting, grading, and excavating are carried out at a fraction of the cost otherwise necessary."

AT PRESENT the great bulk of our nitrates, indispensable for explosives and many other uses, comes from South America. But the United States would never again be caught with a shortage, for the fixation of nitrogen from the air is now a chemical and commercial fact.

There are various methods of extracting nitrogen from the air, where there is an inexhaustible supply. One way is to pass an electric spark of titanic proportions—a veritable thunderbolt—through the air in a chimney, breaking up the atoms and ultimately getting nitrogen as a weak acid.

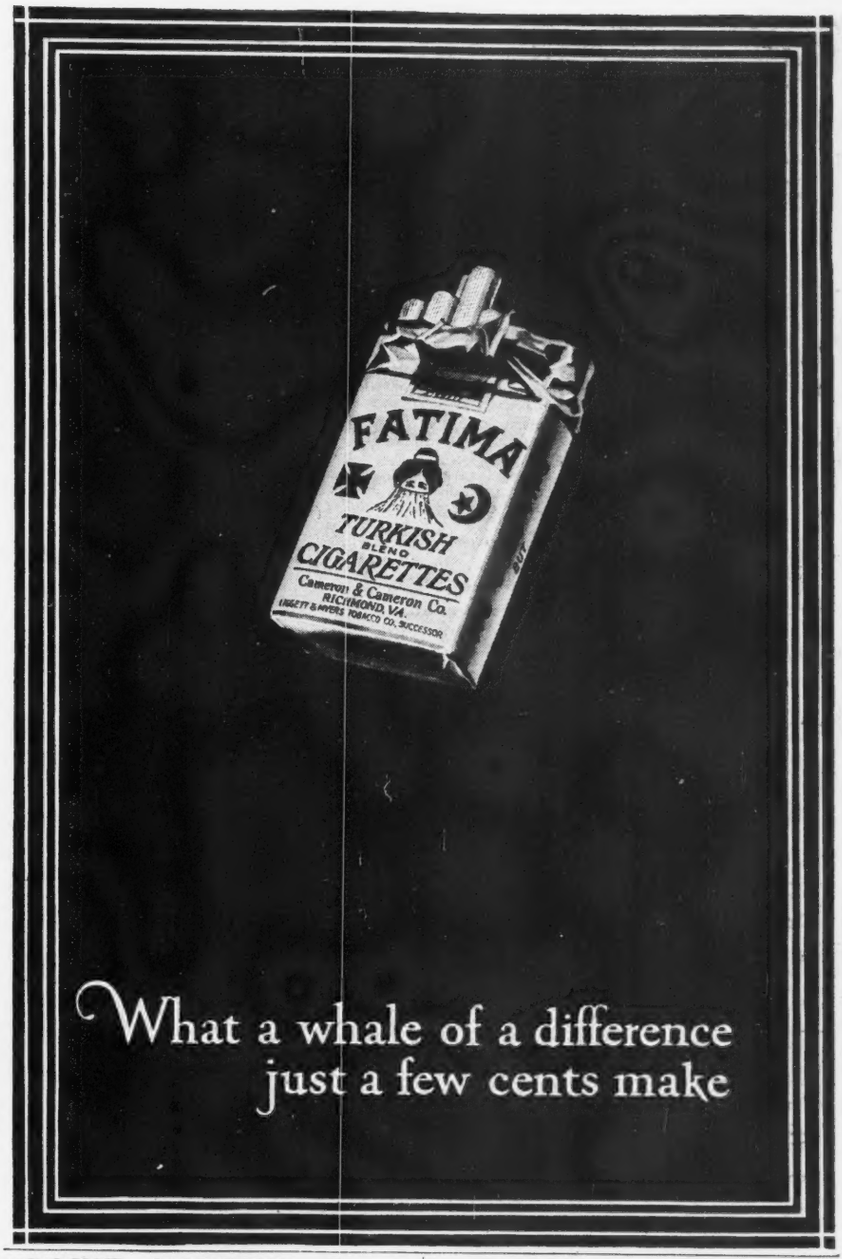
"Smokeless powder," Doctor Stine continued, "is a hard, hornlike material produced by the physical mixing of nitroglycerine and nitrated cotton. The proportion is so selected and the dimensions of the powder grain are such that it will burn completely, converted entirely to gaseous products free from particles of suspended carbon and ash. The burning of this combination is therefore smokeless.

"The manufacture of smokeless powder involves adequate supplies of glycerine, nitric acid, and some form of cellulose. The research laboratory now has produced nitrated cellulose not only from cotton, but from wood pulp and other natural sources. It is not impossible that cellulose will eventually be a product of the research laboratory.

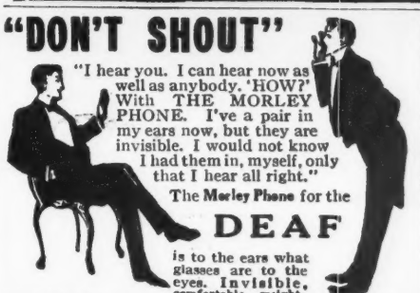
"OUT of cellulose," he went on, "come artificial silk, ivory substitutes that now seem indispensable, leather substitutes, a near-glass that is used largely in automobiles, and various other products that people use every day. Out of the research laboratory has grown a multiplied industry. Even dyes and paints have a chemical relationship to explosives."

Doctor Stine concedes the probability of producing artificially the particular fibrous matter that, as part of wood, is used to make some explosives. Going still further, we may conclude that some day artificial cotton and woolen fabrics may be evolved.

Along this line we might indulge in fantasies. The chemical research workers seem to be on the borderline of a new world of invention.


FATIMA
TURKISH BLEND CIGARETTES
Cameron & Cameron Co.
RICHMOND, VA.
LIGGETT & MYERS TOBACCO CO., SUCCESSOR
What a whale of a difference just a few cents make

"DON'T SHOUT"



"I hear you. I can hear now as well as anybody. 'HOW?' With THE MORLEY PHONE. I've a pair in my ears now, but they are invisible. I would not know I had them in, myself, only that I hear all right."

The Morley Phone for the DEAF

is to the ears what glasses are to the eyes. Invisible, comfortable, weightless and harmless. Anyone can adjust it. Over one hundred thousand sold. Write for booklet and testimonials.

THE MORLEY CO., Dept. 797, 10 S. 18th Street, Philadelphia

AGENTS WANTED

Men and Women

Housewives all over the country want Stuart's—the original—non-alcoholic food flavors and colors in tubes, toilet articles and kitchen specialties. The only way they can get them is through our agents, who easily make

$5 to $8 a Day

C. W. RACK, Mich., says he sold $52 worth in two days; Mrs. BUSH, Iowa, got $10 worth of orders over the phone in four hours. You can do it with our plan. No experience needed. Write at once for details.

C. H. STUART & CO.
668 Lake St. Newark, New York

SEE WHAT PEOPLE MILES AWAY ARE DOING WITH THIS POWERFUL TELESCOPE

Sent in free carrying case with Sling strap.

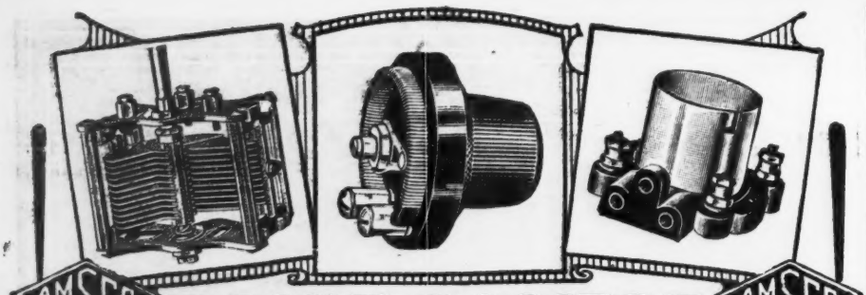
This instrument will be useful nearly every day to see what the neighbors are doing, counting stock, observing help, viewing aeroplanes and inspecting fences, etc., miles away. *Solar eye piece is valuable* for viewing spots in the sun and eclipses of the sun. Excelsior Telescope is the first with Solar Eye Piece to sell for less than $8.00 to $10.00. Beware of imitations. None genuine without *Registered Trade Mark Excelsior.*

Brass Bound, Powerful Lenses, scientifically ground and adjusted. Positively the best Telescope ever sold for this price, $1.85. Objects miles away seen with astonishing clearness.

Because of fortunate purchase from large European maker, we can give you a bargain. Be first in your neighborhood; entertain your friends. SEND NO MONEY; send only name and address for telescope and a soft imitation seal grain leather carrying case by parcel post. On arrival deposit with postman only $1.85, plus a few pennies postage. Satisfaction guaranteed or money refunded. Order today while supply lasts. WE GUARANTEE Absolute Satisfaction or money refunded. Digest of what customers say. Write them, need not take our word. "Witnessed sun eclipse at Austrian Tyrol with it."—L. S. Henry, The Saxon, N. Y. "Excelsior superior in power than a $15.00 one, I own."—Fred Walsh, Howe Island, Ontario. "Could count cattle miles away."—F. G. Patton, Arkansas City, Kansas.

EXCELSIOR IMPORTING COMPANY Dept. TW-2 80 CHAMBERS STREET NEW YORK, N. Y.

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.



AMSCO AMSCO

DON'T GAMBLE

in building your set by using inferior parts. You chance the loss of considerable time, money, and patience if the results aren't satisfactory. Be certain! Use only Amsco parts. Made by men who really know their business, they lead the field in all around performance.

Amsco Parts necessary for those who construct their own include the Low Loss Condenser, a laboratory instrument designed for perfection in set building. Also the Amsco Rheostat, for perfect filament control with all types of tubes and the Amsco Tube Socket with genuine Bakelite Base suitable for panel or table mounting.

At dealers everywhere. Free literature on request

AMSCO PRODUCTS, Inc., Broome and Lafayette Sts., New York (IS)

ADDING MACHINES 1/3 PRICE

Your choice of Burroughs, Dalton, Wales and all standard makes often at less than one-third regular price! All sizes and styles. Every machine guaranteed A-1 condition. Rebuilt by experts.

SOLD ON INSTALLMENTS

You can buy a regular $300 machine for as low as $5 down. Why pay big prices? Hundreds of well-known firms our customers. Write for FREE list of models and bargain prices that save you money. Do it NOW.

RELIABLE ADDING MACHINE CORP. Dept. 104
143 W. Washington Street CHICAGO, ILL.

GERSTNER CASES

are GOOD *Cases* Machinists, Toolmakers and other particular mechanics appreciate their splendid qualities. Catalog free. Write for it to-day.

H. GERSTNER & SONS
516 Columbia St., Dayton, O.

AGENTS EARN A GOOD INCOME

You can sell Premier Knife Sharpeners to housewives, restaurants, stores, etc. 9 out of 10 will buy. Sells for 50c. *Write today for attractive offer.* PREMIER MFG. CO. Dept. 9 Detroit, Mich.

LARGE PROFIT for you

You Can Play a Hohner Harmonica!

This FREE Instruction Book Will Teach You How

Millions of happy people of all ages are now playing Hohner Harmonicas for entertainment, education and popularity. Anyone can quickly learn to play a Hohner with the aid of the Free Instruction Book.

This interesting and instructive book contains a series of easy lessons, charts and pictures which will enable you to quickly master the harmonica and play operatic, classical and jazz selections.

Even though you have had no previous musical training, you can learn to play a Hohner Harmonica. And when you do learn, you will have mastered the first principles of a musical education.

Don't hum or whistle—play it on a Hohner. Ask your dealer for the Free Book today. If he can't supply you, write to M. Hohner, Inc., Dept. 182, New York City.

Leading dealers everywhere sell Hohner Harmonicas—50¢ up.

HOHNER HARMONICAS

Solid Rubber Case

(IS)

You Save 50%

World 6-Volt Storage Batteries are famous for their guaranteed quality and service. Backed by years of Successful Manufacture and Thousands of Satisfied Users. You save 50% and get a

2-Year Guarantee Bond In Writing

World Battery owners "tell their friends." That's our best proof of performance. Send your order in today.

RADIO BATTERIES	
6-Volt, 100-Amperes	$12.25
6-Volt, 120-Amperes	14.25
6-Volt, 140-Amperes	16.00
AUTO BATTERIES	
6-Volt, 11-Plate	$12.25
6-Volt, 13-Plate	14.25
12-Volt, 7-Plate	17.00

SEND NO MONEY

Just state battery wanted and we will ship day order is received, by Express C. O. D., subject to your examination on arrival.

Extra Offer: 5% discount for cash in full with order. Buy now and get a guaranteed battery at 50% saving to you.

Approved and Listed as Standard by Leading Authorities including Radio News Laboratories, Popular Science Institute of Standards, Popular Radio Laboratories, Radio Broadcast Laboratories and Lefax, Inc.

Solid Rubber Container

Now Standard equipment on *all* World Storage Batteries. No more leakage or breakage of jars or rotting of box.

WORLD BATTERY COMPANY
1219 S. Wabash Ave., Dept. 7 Chicago, Ill.

World

Here Are Correct Answers to Questions on Page 71

1. A little over 27,000 gallons of water for each acre of land. One inch of rain in New York City means that about five and a half billion gallons of water fall on the land covered by the city.

2. Deafness sometimes is due not to any trouble with the nerves of hearing or with the little water-filled sac in which these nerves end, but merely to some ear obstruction that prevents the sound vibrations from reaching this sac. In cases of this kind sound vibrations that enter the teeth may be conducted to the ear-sac through the bones of the head and may be heard in this way.

3. Nowadays the commonest materials for phonograph records are those belonging to a class of manufactured substances sometimes called "artificial resins." The artificial resins are made by chemical processes, mainly out of products of the distillation of coal.

4. A little air dissolves in water, just as salt or sugar does. When a glass of water stands around for a while, some of this air comes out of solution and makes the little bubbles.

5. A few fishes eat seaweeds or other fishes, but most fishes live on the microscopic plants and animals, millions of which are contained in every cubic inch of the surface water of the sea.

6. The full moon is *always* visible in the daytime when it is above the horizon and not hidden by clouds. Daylight simply makes it less noticeable.

7. They really evaporate just as water does out of an open pan. The chemical from which moth balls are made is one of the substances that can evaporate directly from the solid state without having to pass through a liquid one.

8. Yes, any electric motor can interfere with radio in its neighborhood if the motor is improperly adjusted, so that sparks are produced at its commutator. This causes a clicking in near-by radio sets as the motor turns. It usually can be stopped by overhauling the motor.

9. Probably, but not for a very long time. There is no friction in empty space, as there would be if the earth were revolving in air. The only known thing that is tending to stop the earth is the friction of the tides in the ocean. Probably this really does slow up the earth a very little, but the slowing is so small that science so far has not been able to detect it.

10. Because of the powerful magnets in the dynamo. The little hair-spring of your watch is made of steel. Under the influence of the magnets this spring sometimes gets magnetized. After that it attracts the other steel parts of the watch and will not work properly.

11. It is the unit in which scientists measure the strength of light. Originally it was the strength of the light given out by a standard candle made of a certain kind of wax and of a certain fixed size. A light one candlepower strong is just about visible a mile away on a clear, dark night.

12. Yawning is a stretching and relief of the muscles of the chest and of the breathing apparatus, usually after these muscles have been tense for some time.

(IS) This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

Do Your Eyes Lie?

(Continued from page 38)

sible to change the ugly thing and make it seem quite beautiful.

To go back to the house proposition, for instance. You have seen how easy it is to transform an exterior. Suppose we discuss a few things we might do with the interior of a house.

If the builder has placed your mantelpiece too high, you don't have to sit and bewail your fate at having all your rooms look ill-proportioned. You simply place two long, tall vases on the floor, at each end of your mantelpiece. Your imagination draws the connecting lines that seem to draw down the mantelpiece. Or you might place two low, fat vases on the ends of the mantelpiece itself, and one of those broad, fat clocks in the middle.

IF YOUR whole room is too high, try placing objects with vivid colors, such as bowls of bright flowers, on the tables; not on the mantelpiece. By such methods you can direct the eyes where you will; you can keep them down if you like.

Or perhaps your room is too low. Then you would run parallel stripes, rather pale in color, from the floor to the ceiling, or you would place a long mirror high on the wall, to reflect the ceiling, and so make your room look lofty. Mirrors always give a feeling of space.

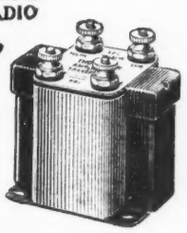
Nowhere is the principle of color harmony—and, for that matter, the principle of line—more important than in dress. I can give you one very simple instance that illustrates them both. Just recently we have discovered that a row of white glass buttons straight down a black dress, from the throat to the hem, can give a look of slenderness. You can suggest a line just by three or four buttons. Or, you will be astonished to find how slim you can make yourself look by wearing dresses cut with the lines sloping inward a little toward the top. That adds an inch or so to your height, too.

Then there are the "distinctive," as the advertisers would say, sleeves and cuffs. If you have short fingers, you'll be surprised to discover how much longer they look when you wear a cuff that droops over the hand. And you'll be equally surprised to discover how much shorter they look than they really are if you wear a number of rings or if you wear a bracelet close to your hand.

THEN there are shoes. If you have normal sized feet, you never have to worry about them. If you haven't, there are all sorts of things that will help you make them look normal. A short vamp, for instance, makes the foot look shorter. With a long vamp, the reverse is true. Laced shoes make the ankle look smaller, just as button shoes make the instep look higher. The black patches on the fancy white sport shoes that run back from the toe along each side, make the whole shoe look smaller by luring the eye away from the true outline.

If you can take an ugly outline and superimpose a beautiful outline, you deceive the eye into seeing only the beauty and being oblivious of the ugly. And that is the esthetic value of optics.

ZENITH KENNEDY Radiodyne THERMIODYNE ULTRADYNE MURDOCK AZARKA Pfanstiehl MICHIGAN Deresnadyne MALONE LEMON MASTER RADIO ROYAL Howard Pathé HARMONY AUDIOLA GLOBE EAGLE AND MANY OTHERS



USE THORDARSONS! FOLLOW THEIR LEAD

Super Het Builders!

For the "Best" 45,000 Cycle Super-Heterodyne, "RADIO" and other leading publications recommend in highest terms the Thordarson 2:1 ratio transformers. Take no others!

Follow the Lead of the Leaders!

Build or replace with Thordarsons

Leading set builders have scientific laboratory apparatus to test, compare and **prove the facts** about transformers. **They continue to use more Thordarsons than all competitive makes combined!** Doesn't this answer the amplification question?

Unconditionally Guaranteed

THORDARSON Super AMPLIFYING TRANSFORMERS

Standard on the majority of quality sets

They Say

(Continued from last month)

THEY SAY OF THE ANDREWS DERESNADYNE:

"It secures the finest tone and high selectivity with increased volume and distance. It brings to the home reproduction of music really comparable to the original. In volume the Deresnadyne will give anything from a mute tone to a volume that fills a large hall."

Deresnadyne amplifies with Thordarsons!

THEY SAY OF THE RADIODYNE:

"When you own a Radiodyne you can hear singers' voices and orchestral harmonies faithfully reproduced through the loud speaker . . so clear and distinct that you lose nothing."

Radiodyne amplifies with Thordarsons!

All stores can now supply Thordarsons. **No need to accept substitutes.** If dealer is sold out, order from us and mention his name.

TYPES AND PRICES; Thordarson "Super" Audio Frequency Transformers are now to be had in three ratios: 2-1, $5. 3½-1, $4. 6-1, $4.50. Thordarson Power Amplifying Transformers are $13 the pair. Thordarson Interstage Power Amplifying Transformers, $8. Write for latest hook-up bulletins—free!

THORDARSON ELECTRIC MANUFACTURING CO.
Transformer Specialists since 1895
WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS
Chicago, U.S.A.

AGENTS 500% PROFIT

GENUINE GOLD LEAF LETTERS

Guaranteed to never tarnish. Anyone can put them on stores and office windows. Enormous demand, large profits, Paul Clark says: smallest day $28.70. R. L. Reel made $920 in two months. Write today for free sample and liberal offer to general agents.

METALLIC LETTER CO., 433A N. Clark Street, Chicago

DRAW CARTOONS

TURN YOUR TALENT INTO MONEY

Cartoonists earn from $50 to $300 per week—some even more. Our new *Circle System of Drawing* quickly trains you to become a cartoonist. Send 6c in stamps for **booklet** and sample **lesson plate** explaining full details of course.

THE NATIONAL SCHOOL OF CARTOONING
415 Park Building Cleveland, Ohio

JUST 17c a Day Pays for this Beautiful Chair

Tapestry or Velour

Over 1000 other bargains. Furniture, Rugs, Lamps, Silver, China, Blankets, Stoves, etc. **Save Big Money** at our Factory-to-Family prices. Pay as little as $3 down; up to a year and a half to pay balance. Get all your Furnishings at once—pay as you use. Thousands buying this new way.

Big Catalog FREE

New Spring *"Larkin Book of Better Homes."* Shows everything for parlor, porch, dining-room, bedroom, kitchen. **Bargain Prices** on famous Symphonola Phonographs. Also Symphonic Pianos, Player-Pianos in genuine Mahogany, Walnut, Fumed Oak. Free trial. Up to 4 years to pay. Satisfaction or money back. Check below article interested in.

☐ **Home Furnishings**
☐ **Pianos or Players**
☐ **Phonographs**

Cut out this adv.—write TO-DAY for FREE Book.

Larkin Co Inc.
Dept. 440, BUFFALO, N. Y.
Peoria, Ill. Chicago, Ill.

NOW—*the* Caille 5-Speed Motor in a Light Weight Twin

Raising and lowering steering handle changes pitch of propeller blades giving variable speeds forward, reverse and neutral in addition to spark and throttle control. (See cut below.) Motor has twin cylinders—no vibration. Light weight. Rope starter. Send for our *free* book on Rowboat Motors.

THE CAILLE PERFECTION MOTOR CO.
6340 2nd Boulevard Detroit, Michigan

2 Speeds Forward—Neutral—2 Speeds Reverse
Note Change in Pitch of Blades

"They did the work!"

"In September you advertised a one mfd. By-Pass Condenser to be attached across the 'B' Battery. As I had three sets of 'B' batteries (detector, amplifier, and power amplifier), I purchased and installed three of them. They did the work magnificently."

THIS message came from one pleased radio fan—from just one radio fan—but the experience of many others is identical. And you, too, will find that a Dubilier By-Pass Condenser in your set will eliminate noises—purify reception—and do the work magnificently!

Dubilier

CONDENSER AND RADIO CORPORATION

"Old Town Canoes"

Days that merit fond reflection

DAYS when the lake is crystal clear and the sky is cloudless overhead—these are such days as vacation dreams are made of.

Get an "Old Town." Here is a sturdy canoe of unusual beauty. "Old Towns" are low in price. $64 up. From dealer or factory.

The 1925 catalog shows all models in snappy colors. It is free. Write for your copy today. OLD TOWN CANOE CO., 1594 Main St., Old Town, Maine, U.S.A.

play your way ahead

LEADING professionals, like Carroll Martin, famous trombonist of Isham Jones' Orchestra choose Conn instruments because of Conn supremacy in tone, tune, mechanism and *easy playing* qualities. You'll get ahead *faster with a Conn*, socially or professionally—win new friends, make big money if you choose.

Carroll Martin

Cultivate Your Musical Bump

Conn is the only maker of every instrument for band: saxophones, trombones, cornets, etc. Write now for Free Book "Success in Music and How to Win It," by Sousa and other artists, and details of *Free Trial offer*. Mention instrument.

C. G. Conn, Ltd., 432 Conn Bldg., Elkhart, Ind.

CONN BAND INSTRUMENTS
WORLD'S LARGEST MANUFACTURERS

Your Colds

(*Continued from page 41*)

the membranes of the nose and throat too dry, which is harmful. Warm, dry air makes us very susceptible to colds. The humidity never should be allowed to drop below 40 per cent and should be above 50 per cent for the most healthful conditions. How you may determine the humidity of a room by means of a hygrometer, or dry-and-wet-bulb thermometer, is shown in the chart on page 41.

If the relative humidity is below 50 per cent, water should be evaporated in the room. If the home is heated with a hot-air furnace, there is a place provided in the furnace for water. This should be kept full. If it does not supply enough moisture, pans of water may be placed on or below the registers. If the home is heated with steam or hot water, pans of water may be placed on the radiators, or containers for water may be placed behind the radiators.

TO THE factor of humidity as a cause for greater susceptibility to colds in congested centers must be added the ease of travel for germs that thrive in the heart of a crowded city. Every streetcar and subway train, every place of assembly, is a favorite stamping ground for the germs of disease. Moving-picture theaters and other indoor amusement establishments enable them to thrive, multiply, and spread their baleful influence. In the country, on the other hand, these agencies of distribution are lacking, and so the rural population is relatively less susceptible to colds.

For similar reasons, indoor workers are likely to suffer more than those whose occupations keep them in the open air. The exception to this rule is found in the case of the outdoor worker who is subjected to severe exposure. The weakening effects of exposure render him especially susceptible to the graver menace of pneumonia. Another factor of importance is the question of home conditions of the outdoor worker. If he spends his nights in close, ill-ventilated, and congested surroundings, the comparative immunity from minor disorders will be nullified.

In the prevention of colds medical authorities say that there are two important factors:

FIRST, the common cold, at least some varieties, is extremely contagious. Prevention lies in avoiding contact with sufferers; for the colds may be transmitted through the common drinking-cups, roller towels, door-knobs, hand-shaking, sneezing, or coughing.

Second, colds are most apt to attack overfed, under-exercised and constipated people, and those who avoid fresh air. To avoid colds, therefore, keep fit; avoid overeating, eat fruit and fresh vegetables and not too much meat or pastry; get outdoor exercise daily. To keep the tone of the body high, and therefore less susceptible to colds, avoid too heavy, soggy flannel underwear or, on the other hand, underwear of weight so light that it allows a chilling of the skin at every

(*Continued on page 147*)

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

Your Colds

(Continued from page 146)

wintry zephyr. Individuals differ in their requirements in this respect, and it is not wise to lay down any rule.

A quick cold-water sponge, especially of the throat and chest, upon rising in the morning, followed by a brisk rub, will stimulate the circulation in the skin and train it to a quick response. Wet feet, lack of sleep, and over-fatigue bring on many a cold, and should be avoided.

The treatment of the common cold after it appears, never is very satisfactory. However, if the cold is detected at a very early stage, you may avoid some misery by a hot full-tub bath, followed immediately by rest in bed in a fairly well ventilated room for 24 hours or more (preferably three days), light diet, and a brisk purge such as may be accomplished by a dose of magnesium sulphate.

These measures may be helpful in shortening the course of the malady and in preventing involvement of the ear and the cavities of the head, which not infrequently occurs, and remember that a cold is not a simple matter. Neglected, it may lead the way to a really serious disease. The services of the family physician should always be sought in severe attacks of this much neglected malady.

How Quickly Can You Stop Your Car?

(Continued from page 81)

cases each driver had his foot on the accelerator and was forced to shift position. The smallest elapsed time in these instances was 35/100 second. With most of the subjects the time lost was from four- to six-tenths of a second. With hand brakes the average was even higher.

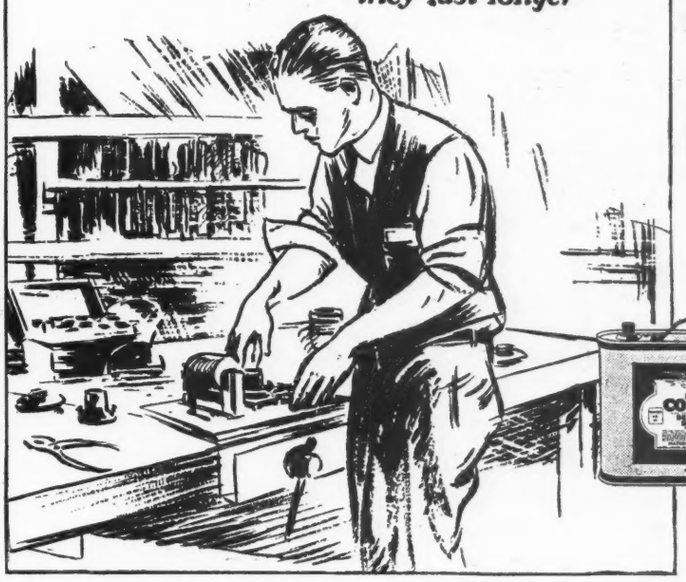
Applied to various rates of speed, the bureau measurements show astonishing results as to the distances traveled in the half-second interval of mental reaction established as the average. At a speed of 15 miles an hour the progress of the car during this interval is 11 feet; at 20 miles, 13 feet; at 25 miles, 18 feet; at 30 miles, 22 feet, and at 40 miles about 28 feet.

The workings of a driver's mind are influenced by many factors. He may have the habit of considering problems unconnected with the immediate job of piloting his car, and may become so deeply absorbed that emergencies do not register quickly on his mind. Some psychologists believe drivers may be hypnotized by such factors as glaring headlights. These observers maintain that the brilliant beams induce hypnotic sleep in the driver who is tensed with watching the road ahead; also that many motorists lose mental control in the sharp glare of concentrated lights from an approaching car.

But whatever may be the cause of mental slack in any individual case, Uncle Sam's scientists believe their measurements will be of practical value in awakening drivers to greater alertness and caution, and in setting new standards of driving efficiency. Further, they believe that present brake-testing methods may be revolutionized by apparatus that more closely duplicates emergency conditions.

Scientists and experimenters choose Eveready Columbias

EVEREADY COLUMBIA Dry Batteries
-they last longer



Popular uses include—
gas engine ignition
telephone and telegraph
doorbells
buzzers
motor boat ignition
heat regulators
tractor ignition
starting Fords
ringing burglar alarms
protecting bank vaults
electric clocks
calling Pullman porters
firing blasts
lighting tents and outbuildings
running toys
radio "A"

Fahnestock spring clip binding posts on the ignitor at no extra cost to you.

FOR home or factory electrical experimental work, Eveready Columbia Dry Batteries are supreme. They give experimenters power of known and dependable quality. Famous scientific and industrial laboratories everywhere use them for delicate work in preference to other sources of electricity. When not in use they rest quietly, renewing their strength for further experiments or tasks of utility and convenience. For every dry battery use, select Eveready Columbia Dry Batteries—they last longer.

Manufactured and guaranteed by

NATIONAL CARBON COMPANY, INC.
New York San Francisco

Canadian National Carbon Co., Limited, Toronto, Ontario

Ask for them by *name* at
electrical hardware
radio
automobile
marine supply
implement and general stores

SEND NO MONEY
2 Genuine Diamonds 4/100 Each
Cut Stones, No Chips
Solid Gold
$25
Terms if desired (6 mos. to Pay)

14 kt. White Gold Top. Gold Emblem (any Lodge) or any Initial (Old English) Inlaid in Genuine
HOPE RUBY
Also, in Black Onyx
Send size of finger and ring will be sent for inspection.
No. 6132
This ◇ Reg. Trade Mark guarantees you genuine diamonds.
Send for Free Catalog D F C M S W Any Letter
Buffalo Jewelry Mfg. Co., "The Mail Order House" Dept. A Brisbane Bldg. Buffalo, N. Y.

Comfort for tired feet!

WORK or pleasure may bring suffering — even torture. But a few drops of Absorbine, Jr. quickly brings relief and makes feet fit for another day.

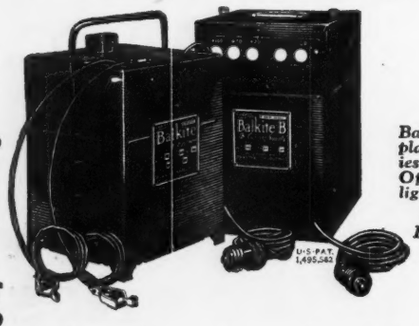
$1.25 a bottle at your druggist's

W. F. YOUNG, Inc., Springfield, Mass.

Absorbine Jr.
THE ANTISEPTIC LINIMENT

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

Balkite Battery Charger. Charges 6 volt "A" storage batteries.
Price $19.50
West of Rockies $20
In Canada $27.50



Balkite "B"—replaces "B" batteries and dry cells. Operates from light socket.
Price $55
In Canada $75

An unfailing power supply for both circuits

Here at last is an unfailing power supply for your radio set. Balkite Radio Power Units furnish constant uniform voltage to both "A" and "B" circuits and give your set greater clarity, power and distance. The Balkite Battery Charger keeps your "A" storage battery charged. Balkite "B" replaces "B" batteries entirely and furnishes plate current from the light socket. Both are based on the same principle, are entirely noiseless, and are guaranteed to give satisfaction. *Sold by leading radio dealers everywhere.*

FANSTEEL
Balkite *Radio Power Units*

BALKITE BATTERY CHARGER — BALKITE "B" PLATE CURRENT SUPPLY

Manufactured by FANSTEEL PRODUCTS CO., *Inc., North Chicago, Illinois*

7 TUBE LOUD SPEAKING

Only $29.50

GUARANTEED LONG DISTANCE RADIO

MIRACO RADIO GETS 'EM COAST to COAST

"Installed the Miraco myself and I have never had any experience with radio at all. Have gotten Havana, Cuba, and Honolulu," reports H. Kittle, Shaw, Miss. "Miraco is a wizard. I have handled radios for two years—have not seen its equal under $200. Heard Havana, Cuba, Saturday night despite that their language is hard to discern on a radio."—C. G. Stockman, Snyder, Neb. "My Miraco works fine. Nov. 28th, I got 5NO, Newcastle, England, and LP, Berlin, Germany. Can you beat that record?"—Thomas Walker, Howell, Mich.

COAST TO COAST RECEPTION verified by Miraco users

California Hears East Coast
Miraco works fine. Last night I got Cuba on loud speaker. I also pick up East Coast programs in spite of local interference.—Clinton Elliott, Long Beach, Calif.

Pennsylvania Hears Calif.
Have listened to Cuba, California and possibly 100 other stations. All who hear Miraco proclaim it the best they have ever heard.—G. H. Stevens, Altoona, Pa.

Reports like these from users in every state prove Miraco Tuned Radio Frequency sets—at rock-bottom prices—have efficiency of sets costing 3 times as much. Made by pioneer set builders. Factory-built, completely assembled, factory-tested, and guaranteed. Easy for beginners to operate. 5 tube set $75. Order direct from this ad or

MAIL COUPON BELOW

for special offer, latest bulletins, further testimony and proof that Radio offers no finer, moderately priced receivers.

DEALERS AGENTS The new Miraco proposition is a winner. Write.

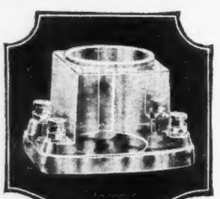
only $14.35

MIRACO RADIO GETS 'EM COAST to COAST

FOR THIS GUARANTEED LONG DISTANCE RADIO

MIDWEST RADIO CORPORATION
408-Y E 8th St., Cincinnati, Ohio
Send free literature, SPECIAL OFFER and full particulars.
☐ USER ☐ AGENT ☐ DEALER
Name.....
Address.....

A New Socket
that means
Better Reception!



After exhaustive research our engineers have developed **Viralon,** a special glass, processed for 100% efficiency. Sturdy and rugged, absolutely heat and moisture proof, and unaffected by those influences that make many other socket materials inefficient as insulation.

Other exclusive features are Ezyklean Contacts (proof against corrosion) — One-Piece Contact Strips—Handy Soldering Terminals, etc. Price $1.25, standard size.

Write for interesting pamphlet

If your dealer cannot supply you, send us $1.25 and parcel post to cover each socket.

DURAY RADIO CORPORATION
Dept. 17, 263 Washington Ave., Newark, N. J.

DURAY
ALL-GLASS
VIRALON
SOCKET

To Select a Loudspeaker

(*Continued from page 78*)

usually is made in such a way that the motion of the armature is magnified at the diaphragm.

All diaphragms have a natural vibration period of their own, and this has to be taken into account in the design of the loudspeaker. Otherwise there will be a tendency to greatly emphasize the tones in human speech or the musical selection that most nearly corresponds to the vibration period of the diaphragm.

The size and shape of the horn has a lot to do with perfect reproduction and there are a thousand and one other difficulties to keep the manufacturer of loudspeakers awake nights figuring out ways to overcome them.

A GREAT many radio fans build their own loudspeakers out of old phonograph horns, or homemade horns, and a single head phone or loudspeaker unit. Often these outfits give excellent results, especially when they are not forced to reproduce loud signals. The homemade loudspeaker that combines great volume with fine tonal qualities is rare indeed, and if you must have both volume and quality, it is best to buy the factory-built loudspeaker.

The most progressive radio dealers today are fitting up soundproof booths in their stores where they demonstrate receivers and loudspeakers. Always be sure to have the dealer show you what the loudspeaker will do on both loud and weak signals and with various stages of amplification. Even if your ear is not musically trained, you can tell when voices sound natural and lifelike. In listening to orchestral selections, see if you can distinguish between the various instruments.

If the voices sound high and tinny, it is because the loudspeaker is failing to reproduce the low notes. Deep, hard-to-understand voices indicate the loss of the high notes and overtones that make human speech clear to the human ear.

Since head phones give such excellent quality, it is worth while to ask the dealer to allow you to listen on a pair of them plugged into the detector stage of the receiver. By listening with a pair of head phones and the loudspeaker alternately, you will be able to judge the quality of the loudspeaker.

IT IS not fair to condemn a loudspeaker offhand because one or two selections do not reproduce clearly. The broadcasting station itself may be to blame, for some of them occasionally send out radio waves that are far from perfect reproductions of the sounds produced in the studio. In justice to the dealer who has no control over the time schedules of the various stations, you should arrange your visit to his store at a time when you know that one of the better local stations is to be on the air with a good program.

IF YOU are a beginner in radio, you won't want to miss an article next month telling how to build a single-tube receiving set of unusually simple construction, yet of high efficiency.

Ⓘ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

How to Build a Radio-Frequency Amplifier

(Continued from page 75)

degrees with the panel *L*. A slight error in setting the angle of the coils will not make much difference, however, since the additional feed-back when the coils couple together can be compensated for easily by a small change in the setting of potentiometer *I*. The sockets *J* and *K* should be placed with the filament binding posts away from the panel *L*.

The filament circuit should be wired first. Connect one terminal on each rheostat and run a branch from this wire to the negative-A-battery binding post 3. Now connect the other terminal of rheostat *G* with the right-hand filament binding post of socket *J* (as seen from the rear). Next, connect the remaining terminal of rheostat *H* to the left-hand filament terminal of socket *K* (as seen from the rear).

The two remaining filament binding posts on sockets *J* and *K* now can be connected and a branch run from this wire to the positive A-battery binding post 4. This completes the filament wiring.

THE outside terminals of potentiometer *I* should be connected as shown in Figs. 1 and 3. One terminal goes to the wire between the rheostats and the other over to the wire from binding post 4.

Run a wire from the end of coil *B* nearest the panel over to the end of coil *D* that also is nearest the panel. A branch from this wire should be connected with the center terminal of potentiometer *I*. Connect the plate terminal of socket *J* with one terminal of coil *C* and connect the other terminal of this same coil with the plus-B binding post 5. Now connect a wire between the rotary-plate terminals of variable condensers *E* and *F*, as shown in Fig. 1, and from this wire run a branch to the wire going to the center terminal of potentiometer *I*.

Next, connect the stationary-plate terminal of condenser *E* with the grid terminal of socket *J* and from this wire run a branch to the remaining terminal of coil *B*. These connections are shown clearly in Fig. 6. Now connect the stationary-plate terminal of condenser *F*, the grid terminal of socket *K* and the remaining end of coil *D* in the same fashion.

AFTER this, connect the plate terminal of socket *K* with binding post 6 and connect the two ends of coil *A* with binding posts 1 and 2, as shown in Figs. 1 and 2. This completes the wiring of the radio-frequency-amplifier unit. The order in which the connections have been described results in making all the hard-to-get-at connections first.

The final step is to connect the radio-frequency amplifier with your receiver.

All ordinary regenerative receivers, regardless of the types of instruments used in them, operate on the same general principle. First there is a coil connected with the antenna and ground. This is called the "primary circuit" and may consist of a few turns of wire placed close to the secondary coil, or of many turns

(Continued on page 150)

The new Tungar will keep your storage batteries up—fully charged all the time. It charges radio "A" batteries of 2, 4, or 6 volts. Radio "B" batteries of 24 to 96 volts. And auto batteries, too.

It makes no disturbing noise—is simple—charges while you sleep. Just clip the Tungar to the battery, plug it in on the house current and leave it overnight to charge. A Tungar at home means clearer tone—full volume—your set at its very best all the time for all that's on the air.

The Tungar is a G-E product, developed in the great Research Laboratories of General Electric.

The New Model Tungar charges Radio A and B batteries, and auto batteries. Two ampere size (East of the Rockies) $18.00

The Tungar is also available in five ampere size, design unchanged (East of the Rockies) $28.00

60 cycles—110 volts

Tungar
REG. U. S. PAT. OFF.
BATTERY CHARGER

Tungar—a registered trademark—is found only on the genuine. Look for it on the name plate.

Merchandise Department
General Electric Company, Bridgeport, Conn.

GENERAL ELECTRIC

Buy Direct from Factory

Combination Ranges $59.80 Up

Get manufacturer's prices. Save 1-4 to 1-2 on stoves, ranges, furnaces, and household goods during the greatest sale in our 25 years' history. Cash or easy payments—terms as low as $3 monthly. Money-back guarantee. 24-hour shipments. 30 days' trial in your home. 530,000 customers endorse Kalamazoo quality.

Send for FREE BOOK

Kalamazoo Stove Co., Mfrs. 781 Rochester Ave. Kalamazoo, Mich.

"A Kalamazoo Direct to You"

ADDING MACHINE VEST POCKET SIZE

ADDS
SUBTRACTS
MULTIPLIES
DIVIDES

$2.50

NEW TRIAL OFFER Does Work of $100 Machine. Total Visible at all Times. —SEND NO MONEY *Guaranteed for Life*

Anyone can operate it. Will not make mistakes. Let this machine do your figuring. First cost is last cost. Do away with pencil stubs and scratch paper. Get yours today.

Just write "Send me a Baby Calculator" and give your name and address. We will ship it immediately, all charges prepaid. On delivery pay postman $2.50. This is the lowest priced practical calculating machine made. *Order today.*

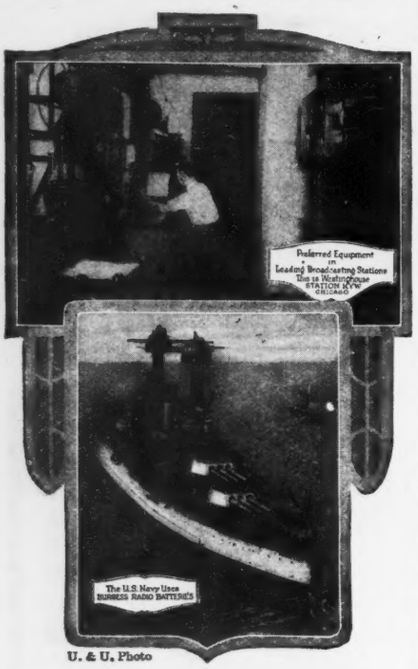
AGENTS

Everybusiness firm, man or woman, will buy the Baby Calculator on sight. BIG COMMISSION.

BABY CALCULATOR SALES CO.
P.O. Box 1118, Dept. 2. Chicago, Illinois

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

More Adventures of BURGESS RADIO BATTERIES



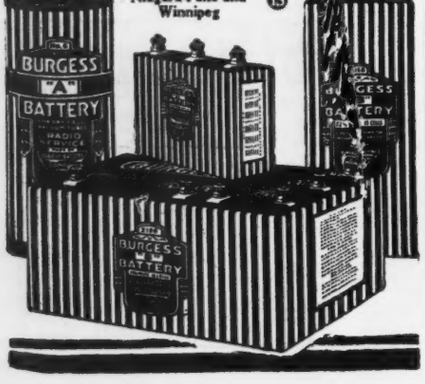
U. & U. Photo

The same Burgess Radio 'A', 'B' and 'C' Batteries which are today faithfully serving the nation's armed forces on land and sea and in the air, and used by leading radio broadcasting stations, experienced radio engineers and amateurs, are sold in your own community by your own dealer for your own receiving set.

When you replace your old batteries, ask your dealer for Burgess. Insist upon this brand of laboratory products—you will receive the same measure of satisfactory service that has won the confidence of the radio public.

"Ask Any Radio Engineer"

BURGESS BATTERY COMPANY
Engineers DRY BATTERIES *Manufacturers*
Flashlight - Radio - Ignition - Telephone
General Sales Office: Harris Trust Bldg., Chicago
Laboratories and Works: Madison, Wis.
In Canada:
Niagara Falls and Winnipeg



A Radio-Frequency Amplifier

(*Continued from page 149*)

placed farther away from the secondary and tuned either by means of taps or a separate variable condenser.

The secondary circuit consists of a coil connected with the grid and filament of the detector tube and tuned by means of a variable condenser or a variometer.

The third circuit is a coil connected between the plate terminal of the detector tube and the plus-B binding post of the set. In some receivers this coil is arranged so that it can be rotated close to the secondary coil. This is known as tickler feed-back. In other sets a variometer is used to obtain feed-back by tuning the plate circuit.

So-called single-circuit sets are those in which the secondary coil is also used as the primary.

In order to hook up this radio-frequency-amplifier unit to your present receiver, you must first convert your set into a simple detector circuit and then place coil *X*, shown above dotted lines in Fig. 2, close to the secondary circuit of your receiver. How to do this is shown in Figs. 7, 8, and 9. The foregoing discussion of the principles on which the regenerative receiver operates is included only so that you may be able to figure out how to make the hook-up if your receiver is outwardly somewhat different from the ordinary types.

IT IS assumed that your receiver already includes one or two stages of audio-frequency amplification, for most radio fans will not be interested in adding radio-frequency amplification unless they already have a stage or two of audio amplification to bring the signals they receive up to loudspeaker strength.

Figure 7 shows the changes to be made in a so-called single-circuit receiver in order to add the radio-frequency amplifier. The coil *X* of Fig. 2 is here shown wound around the detector tuning coil after the antenna and ground have been removed and the tickler coil (the rotating coil) has been removed from the circuit. Be sure to take the tickler coil completely out of the circuit, for if you simply connect a wire across its terminals, you will have a choke that will kill the signal strength.

Coil *X* should consist of about four turns of wire. Any size will do—bell wire is particularly recommended because the insulation is heavy enough to allow the wire to be wound on the tuning coil without fear of short circuits.

One end of coil *X* is connected with the binding post that was formerly used for connecting the antenna, and this binding post then should be connected with binding post No. 6 in the radio-frequency-amplifier unit. The other end of coil *X* should be connected with the plus-B amplifier binding post in your set.

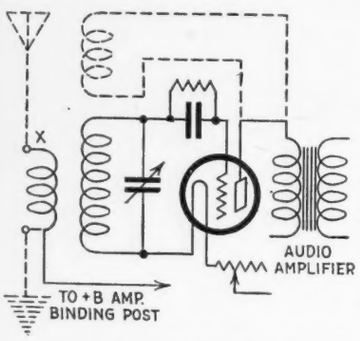


Fig. 8—How to hook the radio-frequency amplifier to a regenerative receiver using aperiodic primary. Four turns of the primary can be used as coil *X*. The antenna binding post should be connected with binding post 6 of the radio-frequency amplifier instead of antenna

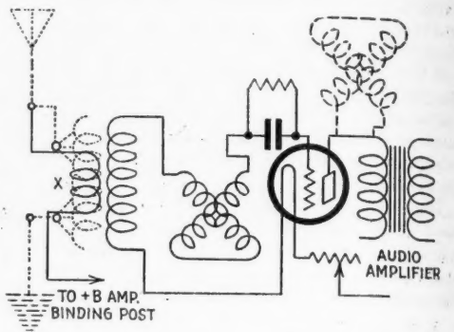


Fig. 9—How to hook the amplifier to a regenerative receiver using variocoupler and two variometers. If your variocoupler has enough taps so that you can get down to four turns in the primary, connect as in Fig. 8; otherwise wind coil *X* on top of the old primary winding, which should be disconnected entirely from the new circuit

FIGURE 8 shows how to combine the radio-frequency amplifier with an aperiodic regenerative tuner such, for instance, as was shown in the four-tube receiver described in the February issue. Here, the primary coil of the tuner will do very well as coil *X*, although it will be well to cut out all but four turns. The other changes consist in connecting the antenna binding post with binding post 6 of the radio-frequency amplifier instead of with the antenna, and then removing the other end of the coil from the ground binding post to the plus-B amplifier binding post in your receiver. Also cut the tickler coil out of the circuit.

Figure 9 indicates the method of connecting the radio-frequency amplifier with a regenerative receiver made up of a variocoupler and two variometers. First disconnect the stationary coil of the variocoupler as shown in Fig. 9, and wind five turns of bell wire on top of the old winding and connect as shown. Then cut the plate variometer out of the circuit entirely.

After the tubes have been placed in the radio-frequency-amplifier unit and the rheostats *G* and *H* turned on so that the tubes are burning about as brightly as in the audio stages of your set, all the tuning can be done with the two dials on the radio-frequency-amplifier unit and the one dial of your present set. If you find that the signals are broken up by howls and squeals at just the point where they come in strongest, turn potentiometer *I* slowly.

Ⓢ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

Alternating Light Current as B-Battery Substitute

(Continued from page 76)

can be made of drinking glasses with the plates hung over the sides. This is a poor method, however, as the water evaporates rapidly and a crust will form all over the tops of the glasses.

The level of the borax solution in the jars or glasses should be adjusted so that the aluminum plates will have not more than one square inch exposed to the solution.

After you have constructed the rectifier, connect it with the current supply, as shown in Fig. 2, with a 50- to 100-watt lamp in the socket. Be sure to connect the lead and aluminum plates exactly as shown. If everything is right, the lamp will light almost to full brilliancy and then gradually become dimmer and finally go out altogether.

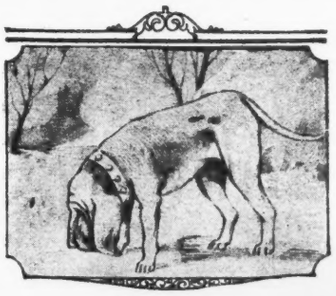
If the lamp does not go out, it is a sign that something is wrong. If you are sure that there are no short circuits in the construction of the caps, try reducing the level of the solution in the jars. If this has no appreciable effect, the chances are that the aluminum is not sufficiently pure for rectifier use.

After the rectifier is working properly as indicated by the lamp's going out, refer to the table at the bottom of page 76 and note the capacity values of the condensers to be used at C_1, C_2, and C_3, according to the number of tubes in your radio set.

The primary circuit of an alternating-current bell-ringing transformer can be used for the inductance L. Such transformers are obtainable in any electrical supply store at a cost of not more than two dollars. Most of the larger stores carry telephone condensers of one- or two-microfarad capacity, suitable for use in this circuit. A variable resistance of the graphite disk type will do very well at R.

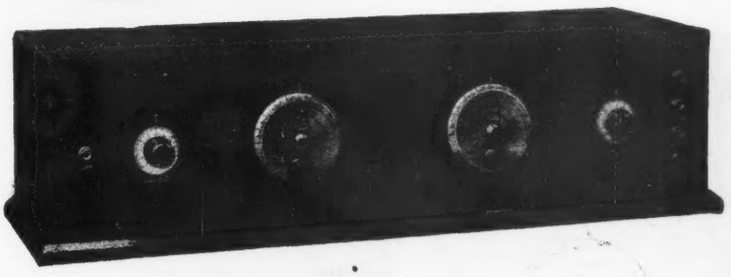
Practically all of the receiving sets made today have the secondary and filament circuits grounded, and since the minus-B-battery terminal is always connected with the filament circuit inside the radio receiver, it will be necessary to place a condenser in series with the ground lead of the receiver. Otherwise the electric-light current will be grounded and the fuses will blow. The value of this insulating condenser is unimportant so long as it is above .002 microfarad. The half-microfarad by-pass condensers are satisfactory for use at this point in the circuit.

The simplest arrangement of the B-battery eliminator is to place the rectifier jars in any convenient corner and mount the parts of the filter circuit on a piece of board fastened to the wall just above the rectifier jars. Do not inclose the jars, for they have a tendency to heat up after several hours of operation, and if they are closed in the temperature of the solution will rise to a point where the jars no longer will act as rectifiers. For this reason it is well also to place a double-pole, single-throw switch in the supply line so that the rectifier can be cut off from the house current when the radio set is not in use. If the vent hole is small, the rectifier should give from six to eight months' service without attention.



Sensitivity

With the extreme acuteness of the bloodhound's scent, the Model L-2 Ultradyne detects the faintest broadcast signals—signals that are "dead" to other receivers—regenerates and makes them audible on the loud speaker.



You Can Build the ULTRADYNE MODEL L-2 With this Book

BUILD this famous receiver yourself and save money. This book, "How to Build and Operate Ultradyne Model L-2," by R. E. Lacault, E. E., A. M. I. R. E., originator of the Ultradyne, makes it easy for anyone to build this remarkable receiver.

The Ultradyne book explains the "Modulation System" of radio reception and a special adaption of regenertion, as used exclusively in the Model L-2 Ultradyne. This is the latest development of R. E. Lacault, Chief Engineer of this Company and formerly Radio Research Engineer with the French Signal Corps Research Laboratories.

This exclusive feature makes the Ultradyne the most sensitive set known—capable of detecting the faintest broadcast signals, making them audible on the loud speaker. Also the most selective receiver known—regardless of close similarity in wavelength, the Ultradyne selects any station within range, brings in greater distance, clearly, distinctly, faithfully, on the loud speaker.

The regular advertised price of the Ultradyne book is 50c. This 25c Coupon is a special offer only to introduce the Ultradyne Circuit to readers of Popular Science.

Standard Price 50c

25¢ **This Coupon is Worth 25¢** 25¢

PHENIX RADIO CORPORATION,
5-7-9 BEEKMAN ST., NEW YORK CITY

Gentlemen: Enclosed find 25c in stamps, together with coupon valued at 25c, for which please send me your regularly priced Book of Instructions on "How to Build and Operate Ultradyne Model L-2."

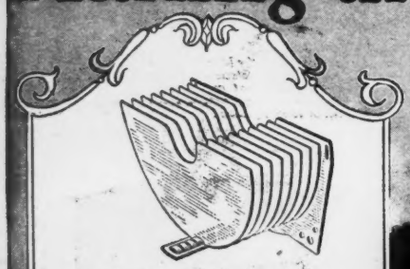
Name .....

Address .....

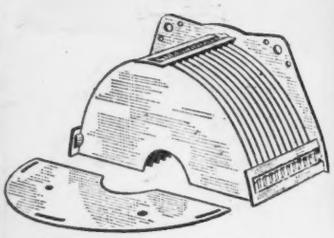
25¢ 25¢

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

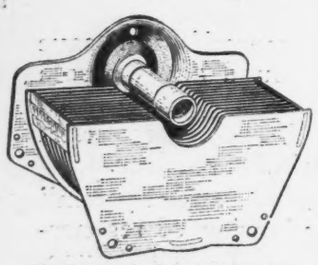
Making the New Bradleydenser



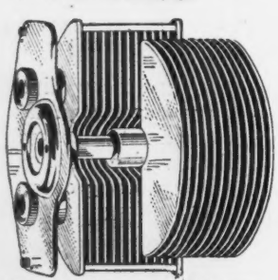
The brass stator plates are soldered to notched spacer bars that maintain perfect alignment.



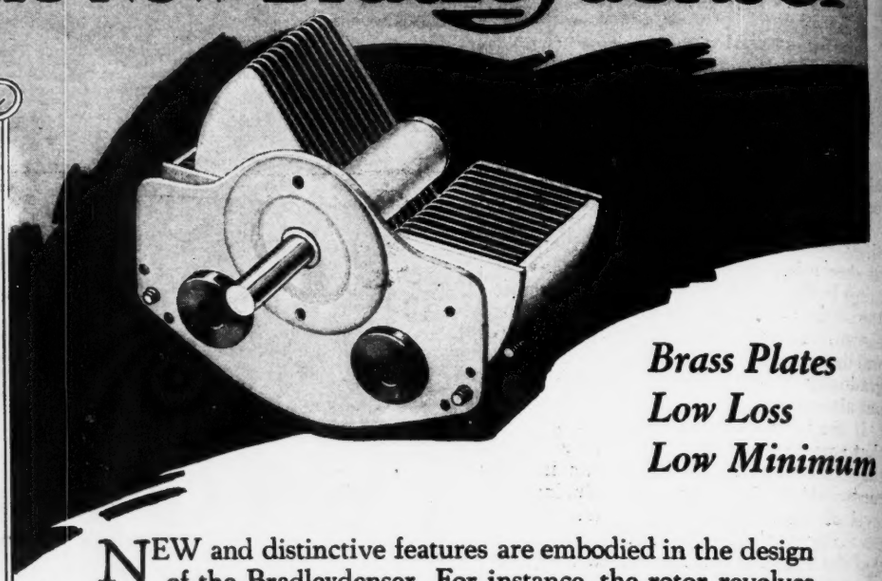
Plates, spacer bars and end plates are all soldered into a solid unit.



The bearing stud, attached to the stator mounting plate, supports the rotor. See illustration at bottom of this page.



Rotor revolves on a double bearing that is independent of the dial shaft.



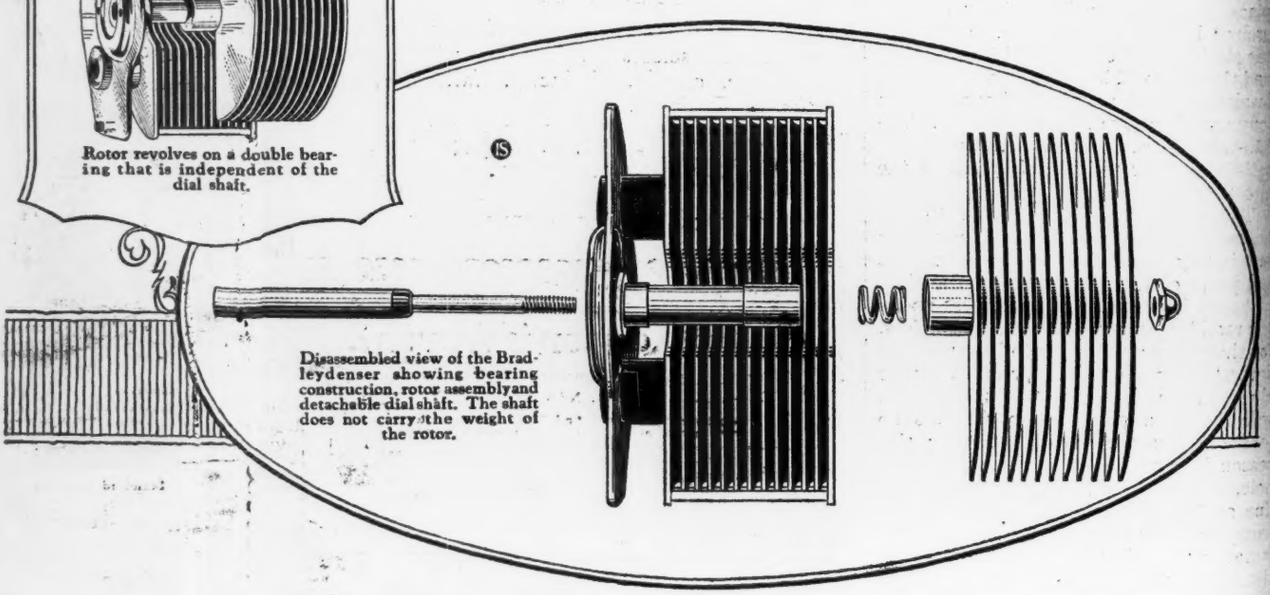
Brass Plates
Low Loss
Low Minimum

NEW and distinctive features are embodied in the design of the Bradleydenser. For instance, the rotor revolves on a long double bearing that preserves rigid alignment and yet eliminates the extra outer end-plate. This reduces the amount of di-electric material and increases the efficiency.

Every joint is soldered. This, combined with the use of brass plates, further increases the operating efficiency. Another feature is the dust cap over the stator plates; it is removable without tools.

The Bradleydenser is made in four sizes: 0.00025 M-f. at $4.50; 0.00035 M-f. at $4.75; 0.0005 M-f. at $5.00; and 0.001 M-f. at $6.00. Leading radio dealers are showing them, now.

Allen-Bradley Co.
Electric Controlling Apparatus
293 Greenfield Avenue MILWAUKEE, WIS.
Manufacturers of Electric Controlling Apparatus for Over Twenty Years



Disassembled view of the Bradleydenser showing bearing construction, rotor assembly and detachable dial shaft. The shaft does not carry the weight of the rotor.

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 25.

ART COLOR PRINTING CO., NEW YORK